OPINIONS REGARDING A MODERN MATHEMATICS PROGRAM FOR SECONDARY SCHOOLS

A THESIS

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S.S.R.

DEDICATION

To

My personal friend, Mr. Alfred A. Jones, my sisters, Miss Dora "Candy" Reynolds, and Mrs. Nina Bell Easly, my mother, Mrs. Vera B. Reynolds and my brothers for their encouragement, patience and interest during the period of the research.

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CHAPTER I

INTRODUCTION

Rationale.--The field of mathematics-education, in recent years, has been characterized by an increasing concern for developing a mid-twentieth century set of objectives and a course of content appropriate for a society which is urban-technological and in constant change. However, research studies have far outstepped application in either curriculum revision or in development of an appropriate set of objectives. Moreover, the traditional mathematics program has failed to reflect adequately the spirit of contemporary mathematics, which seeks to study all possible patterns recognizable by the mind--by so striving it has tremendously increased the power of mathematics as a tool of modern life.[1] The traditional mathematics program did not give proper emphasis to the fact that the developments and applications of mathematics have always been not only important but indispensable to human progress.[2]

The use of the terms "new" or "modern" mathematics is, perhaps, unfortunate. Actually, modern mathematics is the mathematics which is being developed today, with special significance for the second half of the twentieth century. Some general characteristics of modern

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[1] W. W. Sawyer, Prelude to Mathematics (Baltimore: Pelican-Penguin Book Company, 1955), p. 12.

[2] College Entrance Examination Board, Program for College Preparatory Mathematics, A Report of the Commission on Mathematics (New York: College Entrance Examination Board, 1959), p. 9.

mathematics are that mathematics is no longer considered a tool subject; mathematics is considered as a man-made subject which is neither infallible or immutable. Modern mathematics is moving away from the physical world, although it offers many new and practical applications. This is to say that modern mathematics is becoming more and more abstract. Most of the "new" mathematics is being developed with no specific application in mind. The modern areas in mathematics are called new because they have not been included in school programs before.

Certain fundamental ideas in mathematics occur and recur. This gives rise to basic structures or patterns which help to integrate and strengthen mathematical ideas. The modern mathematics program is essentially a search for new patterns. Learning and application are facilitated by discovery of common patterns and generalizations. These are emphasized in the modern mathematics program, but were given less significance in the traditional mathematics program. Recently, mathematics has found great applications in economics, psychology, and in the social and biological sciences. Some of these patterns are common to algebra and geometry, which today means a closer integration of these areas. This unification and integration of mathematical ideas and procedures are characteristics of modern mathematics. This is to say that the total mathematics program should provide a continuity of experience and a sequence of topics.

Recently, Longuet, a British expert on fluid dynamics, stated:

> Mathematics may be compared to a great tree, ever putting forth green shoots and new branches, still, nevertheless, having the same firm trunk of established knowledge. The new shoots are evidence of life; the trunk is essential for the support of

the whole.[1]

Finally, the fast-growing national needs for people skilled in various branches of mathematics provides a compelling reason why an improved mathematics program is of utmost importance. Twenty years ago college or secondary teaching absorbed all but a handful of persons holding master's or doctor's degrees in mathematics; there were no jobs other than teaching available to them. Today the applications of mathematics in electronics, in the use of computing machinery, in industrial research, in automation, and in a dozen other areas have opened up new opportunities and created new demands.[2] This outcome of the extension of mathematics was in recognition of the inadequacies of traditional mathematics to improve classical mathematics. Mathematicians and educators cooperated to produce a sequential program for the entire school, perhaps, for the first time. Since 1960, more money and public concern have been expressed, and the climate of opinion is favorable to an improved mathematics program.

Evolution of the problem.--Among the influences leading to the resurgence of interest in the college-preparatory mathematics program has been the abundant evidence of public dissatisfaction with traditional mathematics programs. The writer became interested in this problem while enrolled in one of the colleges in the Atlanta University Center, Atlanta, Georgia. After completing a course of study for four years in mathematics, and evaluating the outcomes, the writer began to

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[1] M. S. Longuet, Mathematics in an Industrial Economy (Detroit: Industrial Mathematics Society Press, 1958), p. 6.

[2] College Entrance Examination Board, op. cit., p. 8.

wonder what sequence of courses in mathematics could have been pursued in high school that would have accelerated progress in the field of mathematics.

A second factor which caused the writer to become interested in this area, was the fast growing national need for people skilled in the various branches of mathematics. It has been observed, by the writer, that the level of mathematical competence of a large number of American high school graduates is low. Colleges complain that the entering freshmen are poorly prepared in mathematics. The requirements for high school graduation in many states are exceedingly limited. On the basis of these complaints, the writer assumed that too large a percentage of high school students are enrolled in an outmoded mathematics program, since they appear to have difficulty when they reach college.

If the nation is indeed faced with low levels of mathematical competence--and according to the research workers, it is--the writer believes that part of the solution to our present shortages of manpower in areas of mathematics, may be found by making improvements in the appropriateness of course content for those who will go beyond the high school level.

Contribution to educational knowledge.--Perhaps, the value of this proposed research lies in the extent to which the findings may:

1. Aid in greater improvement of college-preparatory mathematics programs in the schools studied.
2. Lend itself to the development of suggestions for removing weaknesses in the present college-preparatory mathematics programs utilized in the school systems studied.
3. Suggest recommendations for a more appropriate college-

preparatory mathematics program for the schools studied.

4. Serve as a course of reference for those concerned about initiating an improved college-preparatory mathematics program.

5. Render added substantiation in the area of public opinions.

Statement of the problem.--The problem involved in this study was to identify and analyze the opinions of a selected group of high school and college teachers of mathematics regarding a proposed modern college-preparatory mathematics program for grades nine through twelve.

Purposes of the study.--The major purpose of this study was to make a comprehensive analysis of the opinions held by high school and college teachers in the Metropolitan Atlanta area to the "new mathematics."

More specifically, the purposes of this study were:

1. To determine what college preparatory courses are presently being offered in the schools in which the subjects taught grades nine through twelve.

2. To ascertain the opinions held by a selected group of high school and college teachers regarding a proposed college-preparatory mathematics program for grades nine through twelve in terms of academic courses and objectives.

3. To identify the differences, if any, among the opinions held by the participating groups of subjects responding to the questionnaire.

4. To present the findings, derive conclusions and implications, and make recommendations pertaining to a new and modern college-preparatory mathematics program in the final thesis copy.

Definition of terms.--For the purpose of clarity, certain terms used in this study have been defined:

1. "College-Preparatory Course" refers to a sequence of subjects or group of courses prerequisite for college

enrollment.[1]

2. "Mathematics Program" refers to an original plan utilized in conducting mathematical experiences in a shool system.

Limitations of the study.--This study was limited to a purposive sample of high school and college teachers in the Metropolitan Atlanta area. This study was also mited by its design, and the data collecting techniques utilized.

Research Design

Locale - This study was conducted in Atlanta, Georgia during 1964.

Subjects and materials - The subjects and materials which were involved in this study were:

1. Subjects: The subjects were a selected group of fifty high school teachers and thirteen college teachers employed in all of the high schools and colleges in the metropolitan Atlanta area.

2. Materials: The basic data-gathering instrument was a specially designed questionnaire which was structured by compiling a set of criteria from the literature, submitting these criteria to a jury of experts, formulating the criteria into a set of questions, submission of the questionnaire to a jury, re-formulating the questionnaire from their reactions, and submitting the questionnaire in its final form to a selected group of high school and college mathematics teachers in effort to collect their opinions pertaining to a proposed program of college preparatory mathematics at the high school level.

Method of research.--The Descriptive-Survey method of research, employing the techniques of the questionnaire and the interview, was used to gather the data necessary to the pursuit of this study.

Procedural steps.--The data necessary to the development of this

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[1] Carter V. Good, Dictionary of Education (New York: McGraw-Hill Book Company, 1945), p. 109.

study were gathered, analyzed, interpreted, and presented through the following steps:

1. Permission to conduct this study was secured from the proper authorities.
2. The related literature pertinent to this study was reviewed, summarized, and presented in the final thesis copy.
3. Questionnaires were prepared to collect the data.
4. The participants concerned in this study were contacted to secure their cooperation and to orientate them as to the nature and scope of the proposed research problem.
5. Copies of the questionnaire were distributed to all of the subjects who were to participate in the study.
6. The data were interpreted, analyzed, and assembled into appropriate tables in keeping with the nature and purposes of the study.
7. The findings, conclusions, implications, and recommendations were formulated and incorporated in the final thesis copy.

Survey of Related Literature

There is an abundance of available literature on the mathematics program, the majority of which are found in reports, theses, and books. This review focuses on the following:

1. The objectives of the mathematics program
2. The influence of national organizations on the mathematics program

The objectives of the mathematics program.--Mathematics objectives have been classified into two groups--the general mathematics objectives and the more specific mathematics objectives.[1]

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[1] William D. Reeve, Mathematics for Secondary Schools (New York: Holt Book Company, 1954), p. 40.

Most authorities propose that a list of objectives set-up in a given situation should not be considered as either final or complete. The teacher who feels so inclined and who has reasonable confidence in himself should modify the list to meet the needs of the community in which he is to serve, keeping in mind that everything included should be appropriate material--in other words, the objectives should be functional as well as fundamental.[1]

The broad general objectives of mathematical instruction have been variously classified by several educators, but their statements represent little more than differences in emphasis on various aspects of the practical disciplinary and cultural objectives as advocated by the National Committee on Mathematical Requirements.[2]

For example, Young wrote on the practical values of mathematics:

> There is no subject, except the use of the mother tongue, which is so intimately connected with everyday life, and so necessary to the successful conduct of affairs as mathematics.[3]

Of the disciplinary value, Young said:

> The facts of mathematics, important and valuable as they are, are not the strongest justification for the study of the subjects by all pupils. Still more important than the subject matter, mathematics is the fact that it exemplifies most typically, clearly and simply, certain modes of thought which are of the utmost importance to everyone.[4]

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[1] Reeve, op. cit., p. 41.

[2] Commission on Mathematics, The Reorganization of Mathematics in Secondary Education, A Report of the National Committee on Mathematical Requirements (Boston: Houghton-Mifflin Company, 1923), p. 12.

[3] J. W. Young, The Teaching of Mathematics (New York: Longman-Green and Company, 1924), p. 13.

[4] Ibid., p. 17.

In a further passage, Young discusses other functions of mathematics and mentions values that are in the nature of attitudes, habits, and skills.[1]

Klapper supported the stand taken by the National Committee on Mathematical Requirements when he expressed the objectives of mathematics instruction in terms of the cultural values. Of the cultural values Klapper said:

> Mathematics, like most subjects in the curriculum, must be taught because society demands the possession of a set stock of knowledge before it will approve the cultural standing of any individual. It insists that he knows the meaning of certain terms and expressions found in daily newspapers such as: "the larger the division, the smaller the quotient," "a changing ratio," "the means and the extremes" and the like.[2]

Davis generalized the aims, as set up by the National Committee on Mathematical Requirements, as follows:

> 1. The cultivation of an understanding of the fundamental concepts and processes of mathematics sufficient to perform efficiently the vocational tasks required of the individual.
> 2. The developmental of the power to think logically, to critically analyze a given situation, to determine relative values, and to reach definite conclusions which can be substantiated.
> 3. The acquisition of an appreciation of mathematics for its precision, beauty power, systematic organization, clarity of symbolic language, exact logical reasoning, and its great capacity for yielding generalizations and predictions.[3]

In the Second Report of the Commission on Post-War Plans, the following objectives were implied at various places:

> 1. The main objectives of the sequential courses in the high school should be to develop mathematical power.

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[1] Young, op. cit., p. 41.

[2] Paul Klapper, The Teaching of Mathematics (New York: D. Appleton, Inc., 1921), p. 20.

[3] David R. Davis, The Teaching of Mathematics (Cambridge: Addison Wesley Press, Inc., 1951), p. 2.

2. The main objectives of the work in the college-preparatory courses should be to develop functional competence in mathematics.[1]

Butler and Wrens gave another set of objectives. Their objectives are social and mathematical. However, they say that a balance between the social and mathematical aims should be maintained in the mathematics program.[2] Their mathematical objectives are as follows:

1. Proficiency in fundamental skills.
2. Comprehension of basic concepts.
3. Appreciation of significant meanings.
4. Development of desirable attitudes.
5. Efficiency in making sound applications.
6. Confidence in making intelligent and independent interpretations.

In the framework of these objectives, the teachers of mathematics must keep up with the current trends in mathematics.[3]

In a study made by Bush, it was found that the above objectives, which were advocated by Butler and Wrens, were agreed upon by many educators. The majority of the subjects participating in the study were generally in agreement with the objectives listed earlier, even though some were expressed differently.[4]

Recently, Harris gave another set of objectives. This set of objectives was for the preparatory mathematics. A summary of these

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[1] Second Report of the Commission on Post-War Plans, "The Improvement of Mathematics in Grades One to Fourteen," The Mathematics Teacher, III (March, 1951), 195.

[2] Charles H. Butler and F. Lynwood Wrens, The Teaching of Mathematics in Secondary Schools (New York: McGraw-Hill Book Company, 1951), p. 101.

[3] Ibid., p. 102.

[4] Evelyn L. Bush, "Mathematics Programs in a Selected Group of Secondary Schools" (unpublished Master's thesis, School of Education, Atlanta University, Atlanta, Georgia, 1961), p. 109.

objectives is as follows:

> The preparatory objectives of mathematics fall into two categories. One concern is the proper foundation which was to be laid for further study of mathematics at school and college, and for further self-preparation. The other concern is the proper foundation for adult occupation. It is the aim of mathematics-education to contribute to the attainment of abilities which help to meet his civic obligation. It also must aim at providing the basic preparation for the adult's vocation or profession.[1]

The influence of national organizations on the mathematics program.--The review of related literature pertinent to this study would be incomplete if references were not made to the important leadership offered from time to time by national committees. In the last few decades there have appeared several important national committee reports which have significantly affected the content and organization of modern mathematics programs in the high schools. Thes first of these was the report of the National Committee on Mathematical Requirements, issued in 1923 under the title, The Reorganization of Mathematics in Secondary Education.[2]

A summary of the outcomes or results of this report was made by the National Council of Teachers of Mathematics in the Fourteenth Yearbook as follows:

> This report furnished important leadership for the future direction of mathematics-education in the United States; it not only provided a statement of objectives and aims, but it suggested matter in mathematics for the high schools. It also encouraged experimentation with new subjects matter in the high schools, and it provided teachers with an account of the latest

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[1] Chester W. Harris, "Mathematics," Encyclopedia of Education Research (New York: The Macmillan Company, 1960), p. 799.

[2] Commission on Mathematics, op. cit., pp. 13-14.

developments in certain aspects of mathematics-education.[1]

The Council further stated:

> The 1923's Committee recommended that plane demonstrative geometry, algebra, solid geometry, trigonometry, elementary statistics, elementary calculus, history of mathematics, and additional elective subjects such as shop mathematics, surveying and navigation should be taught in the high schools.[2]

In 1940 there appeared the report of the Joint Commission of the Mathematics Association of America--the Commission on the Secondary School Curriculum of the Progressive Education Association, and the National Council of Teachers of Mathematics. The report of the Commission went beyond the recommendations of the 1923's report. The Joint Commission prepared a tentative report entitled, The Place of Mathematics in Secondary Education.[3] A summary follows:

> This report contained nine chapters, the first four of which dealt with problems such as: general aims and general objectives of the high school, the role of mathematics in civilization, and the place of mathematics in education. The more mathematical part of the report was considered in the remaining five chapters which dealt respectively with the mathematics programs, the distribution and organization of the material, and the modified curriculum plans. In addition there was a section on the transfer of training.[4]

A committee of the Progressive Education Association prepared a

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[1] Training of Mathematics Teachers, Fourteenth Yearbook of the National Council of Teachers of Mathematics (Washington: The Council, 1940), p. 108.

[2] Ibid., p. 6.

[3] The Place of Mathematics in Secondary Education, Fifteenth Yearbook of the National Council of Teachers of Mathematics (Washington: The Council, 1940), p. 108.

[4] This summary was abstracted from the Fourteenth Yearbook of the National Council of Teachers of Mathematics, Training of Mathematics Teachers, p. 100.

tentative report entitled, Mathematics in General Education,[1] which is a point of view regarding the type of mathematics to be taught in the high school which is somewhat different from that adopted by the Joint Commission. The report takes as its starting point the needs of the individual with respect to four aspects of living:

1. Personal living
2. Immediate personal-social relationship
3. Social-civic relationship
4. Economic relationship[2]

The second part of the report dealt with major understandings growing out of mathematical experience, ranging from the semi-mathematics to the specifically mathematics. However, both reports pay tribute to the National Commission's 1923 reports.[3]

Recently, there have been many reports from National Organizations. In the spring of 1959, the Commission on Mathematics of the College Entrance Examination Board issued a two-part report on the secondary mathematics program for college-bound students. In this report, the Commission recommends revision of the present high school mathematics programs with a suggested sequence of subjects for the program.[4]

The Secondary School Curriculum Committee, under the direction of

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[1] Secondary School Curriculum Committee, Mathematics in General Education. A Report of the Progressive Education Association (New York: D. Appleton-Century, Inc., 1940), p. 20.

[2] Ibid., p. 21.

[3] Leo J. Breckner and Foster E. Grossnickle, Developing Mathematical Understanding (New York: Holt, Rinehart and Winston, Inc., 1961), p. 22.

[4] Kenneth E. Brown, The Revolution in School Mathematics, A Report of Regional Orientation Conferences in Mathematics (Washington: The Council, 1961), p. 20.

F. B. Allen, was appointed by the National Council of Teachers of Mathematics to study mathematics curriculum and instruction in secondary schools in relation to the needs of contemporary society. Sub-committees were formed to make studies and reports in eleven areas.[1] The sub-committee's findings were incorporated in a report first published in May, 1959 issue of The Mathematics Teacher,[2] and subsequently reprinted as a separate publication.

The Rockefeller's Report has had the greatest influence on the high school mathematics program, since it contains an account of the automation revolution, the accompanying long-term increase in the demand for highly educated mathematicians, and the crisis that confront the nation.[3] The Rockefeller's Report further stressed the crisis in mathematics education as follows:

> First, the crisis in our mathematics-education is not an invention of the newspapers, or mathematicians, scientists, or the Pentagon; it is a real crisis.
>
> Second, the U.S.S.R. is not the true "cause" of the crisis. The cause of the crisis is our breath-taking movement into a new technological era. The U.S.S.R. has served as a rude stimulus to awaken us to that reality.
>
> The heart of the matter is that we are moving with headlong speed into a new phase of man's long struggle to control his environment, a phase besides which the industrial revolution may appear a modest alteration of human affairs.[4]

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[1] Brown, op. cit., p. 21.

[2] National Council of Mathematics, The Mathematics Teacher, III (May, 1959).

[3] Pursuit of Excellence: Education and the Future of America (New York: The Rockefeller Brothers, Inc., 1961), p. 36.

[4] Ibid., p. 28.

Finally, the School Mathematics Study Group issued textbooks which were the result of a collaboration between university mathematicians and experienced high school teachers. This Study Group includes college and university mathematicians, high school teachers of mathematics, experts in education, and representatives of science and technology. The general objective of the Study Group was the improvement of the teaching of mathematics in the schools of this country.[1] The Group further stated:

> One of the prerequisites for the improvement of the teaching of mathematics in our schools is an improved curriculum--one which takes account of the increasing use of mathematics in science and technology and in other areas of knowledge, and at the same time one which reflects recent advances in mathematics itself. One of the first projects undertaken by the Study Group was to enlist a group of outstanding mathematicians and mathematics teachers to prepare a series of high school textbooks which would illustrate such an improved curriculum.[2]

Summary of the related literature.--The summarization and interpretation of the related literature pertinent to this research are presented in the statements to follow:

The Objectives of the Mathematics Program

1. Mathematics objectives have been classified into two groups, the general mathematics objectives and the more specific mathematics objectives.

2. There seems to be general agreement upon the mathematics aims by mathematics experts.

3. Pressure from new social needs and demands on mathematical abilities of high school graduates have made it necessary to define the aims of mathematics as social and mathematical aims.

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[1] School Mathematics Study Group, Mathematics for High Schools, A Report Prepared by the School Mathematics Study Group (New Haven: Yale University Press, 1960), p. 3.

[2] Ibid., p. 3.

4. Complaints from college mathematical teachers have made it an important to set up preparatory objectives for the modern mathematics program.

The influence of National Organizations on the Mathematics Program

1. In the last few decades there have appeared several important national committee's reports which have significantly affected the content and organization of the modern mathematics program in the high schools.

2. The first report, which was issued in 1923 by the National Committee, furnished important leadership for the future direction of mathematics-education in the United States and provided teachers with an account of the latest developments in certain aspects of mathematics-education.

3. In 1940, there appeared the report of the Joint Commission of the Mathematics Association of America - The Commission on the Secondary School Curriculum of the Progressive Education Association and the National Council of Teachers of Mathematics which prepared reports that dealt with the objectives and content that should be utilized in the high schools.

4. In 1959, the Commission on Mathematics of the College Entrance Examination Board issued a two-part report on the secondary mathematics program for college-bound students.

5. The Rockefeller's Report has had the greatest influence on the high school mathematics program, since it contains an account of the automation revolution, the accompanying long-term in the demand for highly educated mathematicians and the crisis that confront the nation.

CHAPTER II

PRESENTATION, ANALYSIS, AND INTERPRETATION OF THE DATA

Introductory statement.--The purpose of this chapter is to present, analyze, and interpret data obtained from selected mathematics teachers employed in Metropolitan Atlanta Secondary Schools, and data obtained from college teachers of mathematics employed in the Atlanta University Center. The presentation, analysis and interpretation of the data have been organized under the following captions:

1. General Information on Teachers' Status
2. General Objectives of the Mathematics Program
3. Specific Objectives of the Mathematics Program
4. General Content of the Mathematics Program
5. Specific Content of the Mathematics Program

The data collected in this study were treated with reference to the extent of agreement and disagreement between opinions about modern mathematics as held by teachers when compared to the criteria of principle and methodology set forth by experts in the field of mathematics education.

The significance of the differences on agreement and/or disagreement between the opinions of teachers and those of the experts was measured by a "t" difference for percentages at the .01 per cent level

of confidence with 49 degrees of freedom.

General Information

Number of questionnaires distributed and percentage of returns.--The percentage of returned questionnaires, according to categories as shown in Table 1 are as follows: high school teachers had 40 out of 50 for 80.00 per cent returns, and college teachers had 11 out of 13 for 85.00 per cent returns. Out of the total of 63 questionnaires distributed, 51 or 82.00 per cent were returned.

TABLE 1

NUMBER AND PER CENT OF QUESTIONNAIRES DISTRIBUTED AND RETURNED

Group	Number Distributed	Number Returned	Per Cent of Returned
High School Teachers	50	40	80.00
College Teachers	13	11	84.00
Totals	63	51	Average 82.00

A summary of the data revealed that there was a relatively high per cent of returns of questionnaires, which constituted a representative sample. This was due to the fact that the participants of the study were contacted to secure their cooperation before the questionnaires were distributed. However, many educators feel that about sixty-five per cent of returns constitutes a representative sample.

Sex of the teachers.--The data on the sex of the teachers are

presented in Table 2. The data on the high school teachers reveal that 33 or 58.00 per cent were males and 17 or 42.00 per cent were females. The data on the college teachers reveal that 7 or 64.00 per cent were males and 4 or 36 per cent were females.

TABLE 2

DISTRIBUTION OF TEACHERS ACCORDING TO SEX

	High School Teachers		College Teachers	
Sex	Distribution	Per Cent	Distribution	Per Cent
Male	33	58.00	7	64.00
Female	17	42.00	4	36.00
Totals	40	100.00	11	100.00

A summary of the data revealed that the male teachers dominate in the teaching field of mathematics, while the female teachers seem to lag behind. This could be due to the limited metropolitan area from which the selected samples of participants were determined to participate in this study. This could also be due to the fact that women do not study mathematics as extensively as men. The field of mathematics has been considered as a man's field. Women also marry and leave the teaching profession.

Level of training of the teachers.--The data on the training of the high school and college teachers are presented in Table 3, page 20. The data reveal that of the high school teachers, 14 or 35.00

TABLE 3

DISTRIBUTION OF TRAINING
OF THE TEACHERS

	High School Teachers		College Teachers	
Levels of Training	Distribution	Per Cent	Distribution	Per Cent
Master of Science	14	35.00	3	37.00
Master of Arts	3	7.00	0	0.00
Master of Science and Further Study Toward Doctoral Degree	1	3.00	4	37.00
Master of Arts and Further Study Toward Six-Year Certificate	1	3.00		
Master of Science and Further Study Toward Six-Year Certificate	6	15.00		
Master of Science and Further Study Toward Self-Improvement	6	15.00		
Master of Science and Master of Arts and Further Study Toward Self-Improvement and Six-Year Certificate	3	7.00		
Doctor of Philosophy			2	18.00
Doctor of Education				
Master of Science and Master of Science			2	18.00
Totals	40	100.00	11	100.00

per cent held the Master of Science degree; 3 or 7.00 per cent held the Master of Arts degree; 1 or 3.00 per cent held the Master of Arts degree and were working toward the Doctor of Philosophy degree; 1 or 3.00 per cent held the Master of Arts degree and were working toward the professional six-year certificate; 6 or 15.00 per cent held the Master of Science degree and were studying toward self-improvement; 6 or 15.00 per cent held the Master of Science degree and were working toward the professional six-year certificate; 6 or 15.00 per cent held the Master of Arts degree and were studying for self-improvement; 3 or 7.00 per cent held the Master of Arts degree and the Master of Science degree and were doing further study toward self-improvement and the professional six-year certificate.

The data on the training of the college teachers reveal that 3 or 27.00 per cent held the Master of Science dgreee; none or 000 per cent held the Master of Arts degree; 4 or 37.00 per cent held the Master of Science degree and were working toward a Doctor of Philosophy degree; 2 or 18.00 per cent held the Doctor of Philosophy degree; none or 0.00 per cent held the Doctor of Education degree; and 2 or 18.00 per cent held two Master of Science degrees.

The data on the two groups revealed that the highest level of degree-training was the Master of Science degree at 35.00 per cent for high school teachers and 27.00 per cent for college teachers, respectively. However, for the college teachers, 37.00 per cent held the Master of Science degree plus added recognized training at the Doctoral degree level.

A summary of the data indicated that the mathematics teachers of

this study were aware of the need for more training in mathematics; hence, they were making efforts to improve themselves.

Institutions which conferred degrees on teachers.--The data on the institutions where degrees were conferred for high school and college teachers are presented in Table 4, page 23.

The institutions which conferred degrees on the high school teachers ranked as follows: 31 or 78.00 per cent received the Master's degree from Atlanta University; and 9 or 22.00 per cent received the Master's degree from other institutions.

The institutions which conferred degrees on the college teachers ranked as follows: 7 or 64.00 per cent received the Master's degree from Atlanta University; and 4 or 36.00 per cent received the Master's degree from other institutions.

A summary of the data indicated that the teachers as a group had received the Master's degree in the number of 38 or 75.00 per cent and 13 or 25.00 per cent from Atlanta University and other graduate schools, respectively.

Number of years of study of the teachers.--The data in Table 5, page 23, indicate the number of years of study for the high school and college teachers in order to obtain degrees.

The data on the high school teachers reveal that 36 or 90.00 per cent obtained their degree between 1 and 2 years of entry in college; 4 or 10.00 per cent obtained their degree between 3 and 4 years; and none or 0.00 per cent received their degree between 5 and 6 years.

The data on the college teachers revealed that 7 or 62.00 per cent earned their degree between 1 and 2 years on entry into college; 2 or

TABLE 4

DISTRIBUTION OF INSTITUTIONS WHERE DEGREES WERE CONFERRED ON THE TEACHERS

Institutions	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Atlanta University	31	78.00	7	64.00
Fisk University	1	2.50		
Syracuse University			1	9.00
Kansas State Teachers College and Atlanta University	1	2.50		
New York University	1	2.50		
Northwestern University			1	9.00
Tuskegee Institute	3	7.00		
University of Arizona	1	2.50		
University of Chicago			2	18.00
University of Pittsburg	1	2.50		
Kansas State Teachers College	1	2.50		
Totals	40	100.00	11	100.00

TABLE 5

DISTRIBUTION OF THE NUMBER OF YEARS OF STUDY OF THE TEACHERS

Years of Study	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
1 - 2	36	90.00	7	62.00
3 - 4	4	10.00	2	19.00
5 - 6	0	0.00	2	19.00
Totals	40	100.00	11	100.00

19.00 per cent received their degree between 3 and 4 years; and 2 or 19.00 per cent received their degree between 5 and 6 years.

A summary of the data revealed that a large percentage of both groups earned their degree in between 1 and 2 years. This could be due to the fact that the teachers of both groups were realizing that it was more effective to complete requirements once they have started to graduate school than to stop and start over again.

Degree held by the teachers.--The data in Table 6, page 25, reveal the degrees that are held by the high school and college teachers.

The data on the high school teachers reveal that 27 or 68.00 per cent held the Master of Science degree; 10 or 25.00 per cent held the Master of Arts degree; and 3 or 2.00 per cent held the Master of Science degree and the Master of Arts degree.

The data on the college teachers indicate that 7 or 64.00 per cent held the Master of Science degree; 2 or 18.00 per cent held the Doctor of Philosophy degree; and 2 or 18.00 per cent held two Master of Science degrees.

A summary of the data revealed that the highest percentage of high school and college teachers held the Master of Science degree. It was interesting to note that the high school teachers were as well trained in mathematics as the college teachers. This could be due to the fact that standards of high school teachers have been raised and more money is being made available to the teachers in order to do advanced study beyond the college level.

The fact that the college teachers did not excel the high school

TABLE 6

DISTRIBUTION OF DEGREES HELD BY TEACHERS

Degrees	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Master of Science	27	68.00	7	64.00
Master of Arts	10	25.00		
Master of Sciences and Master of Arts	3	7.00		
Doctor of Philosophy			2	18.00
Master of Science and Master of Science			2	18.00
Totals	40	100.00	11	100.00

teachers in preparation may also be due to the fact that government and industry also are increasingly employing college teachers with doctorate degrees for research.

Fields of study of the teachers.--The data on the fields of study are presented in Table 7, page 26.

The data on the high school teachers reveal that 27 or 68.00 per cent received their degree in mathematics; 10 or 25.00 per cent received their degree in education; and 3 or 7.00 per cent received their degree in mathematics education.

The data on the college teachers reveal that 10 or 91.00 per cent received their degree in mathematics; and 1 or 9.00 per cent received their degree in mathematics and chemistry.

A summary of the data revealed that both groups who participated

TABLE 7

DISTRIBUTION OF FIELDS OF STUDY OF THE TEACHERS

Levels	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Mathematics	27	68.00	10	91.00
Education	10	25.00		
Mathematics-Education	3	7.00		
Mathematics and Chemistry			1	9.00
Totals	40	100.00	11	100.00

in this study have obtained their degrees in pure science or mathematics. This could be due to the fact that more teachers are taking advantages of the grants given by the National Science Foundation in mathematics and science. This could also be due to the fact that both groups are realizing the importance of obtaining degrees in pure mathematics because of the fast growing national needs for teachers to be well qualified in their subject-matter.

Courses in analysis taken by the teachers.--The data in Table 8, page 27, reveal the courses that have been taken in analysis by the high school and college teachers.

The data on the high school teachers reveal that an average of 37 or 86 per cent have taken some type of courses in analysis.

The data on the college teachers reveal that an average of 9 or 84 per cent have taken courses in analysis.

TABLE 8

DISTRIBUTION OF COURSES IN ANALYSIS TAKEN BY THE TEACHERS

Courses	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Trigonometry	40	100.00		
Plane Analytic Geometry	40	100.00		
Calculus	40	100.00		
Solid Analytic Geometry	37	93.00	11	100.00
Advanced Calculus	36	90.00	11	100.00
Differential Equations	38	95.00	11	100.00
Infinite Series	11	27.00	11	100.00
Basic Functions of Analysis			10	91.00
Infinite Series			8	73.00
Fourier Series			3	27.00
Averages	37	86.00	9	84.00

A summary of the data indicated that the teachers in the two groups have taken a variety of courses in analysis. This could be due to the fact that analysis courses are the basic fundamentals for applying the uses of the material to everyday life.

Courses in application taken by the teachers.--The data on the courses that have been taken in applications by the teachers are presented in Table 9, page 28.

The data on the high school teachers reveal that an average of 6

TABLE 9

DISTRIBUTION OF COURSES IN APPLICATIONS
TAKEN BY THE TEACHERS

Courses	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Mechanics (Statics or Dynamics)	11	27.00	4	36.00
Mathematical Physics	7	18.00	1	9.00
Mathematical Astronomy	2	5.00	1	9.00
Actural Mathematics	9	22.00	7	64.00
Averages	6	14.00	3	24.00

or 14.00 per cent have taken courses in applications.

The data on the college teachers revealed that an average of 3 or 24.00 per cent have taken courses in applications.

A summary of the data indicated that some of the teachers in both groups have realized the importance of taking courses in applications. A survey made by the National Council of Teachers of Mathematics revealed that less than fifty per cent of all teachers had taken courses in applications.

Courses in Algebra taken by the teachers.--The data on the courses that have been taken in Algebra by the teachers are presented in Table 10, page 29.

The data on the high school teachers reveal that an average of 32 or 80.00 per cent out of the 40 teachers that participated in this study have taken courses in Algebra.

TABLE 10

DISTRIBUTION OF COURSES IN ALGEBRA
TAKEN BY THE TEACHERS

	High School Teachers		College Teachers	
Courses	Distribution	Per Cent	Distribution	Per Cent
Abstract Algebra	39	98.00	11	100.00
Matrices	29	73.00	11	100.00
Theory of Numbers	25	62.00	10	91.00
Theory of Equations	35	90.00	11	100.00
Averages	32	80.00	10	98.00

The data on the college teachers reveal that of the 11 college teachers who participated in this study, 8 or 73.00 per cent have taken courses in Algebra.

A summary of the data revealed that a high percentage of both groups have taken courses in Algebra. This could be due to the fact that the college's background of both groups were weak, and they realized the importance of taking additional courses in Algebra for self improvement.

Courses in Geometry taken by the teachers.--The data on the courses that have been taken in geometry by the teachers are tabulated in Tabulated 11, page 30.

The data on the high school teachers reveal that out of the 40 teachers that participated in this study, an average of 22 or 55.00 per cent have taken courses in geometry.

TABLE 11

DISTRIBUTION OF COURSES IN GEOMETRY TAKEN BY THE TEACHERS

Courses	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Metric and Other Geometries	22	55.00	9	82.00
Non-Euclidean Geometries	16	40.00	8	73.00
Differential Geometry	23	58.00	7	64.00
Topology	25	62.00	8	73.00
Averages	22	55.00	8	73.00

The data on the college teachers reveal that out of 11 participants, an average of 8 or 73.00 per cent have taken courses in geometry.

It was interesting to note that both high school and college teachers indicated that they pursued substantial learning in the discipline of geometry. This could be due to the fact that more and more teachers are now interested in the field of geometry in order to do advanced study in the field.

Courses in foundations of mathematics taken by the teachers.--The data on the courses that have been taken in foundation of mathematics by the teachers are presented in Table 12, page 31.

The data on the high school teachers reveal that out of 40 participants, an average of 23 or 58.00 per cent have taken courses in foundation of mathematics.

TABLE 12

DISTRIBUTION OF COURSES IN FOUNDATIONS OF MATHEMATICS TAKEN BY THE TEACHERS

Courses	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Theory of Sets	30	75.00	10	91.00
Mathematics or Symbolic Logic	13	33.00	6	55.00
Postulates for Geometry	22	55.00	11	100.00
Postulates for Algebra	24	60.00	10	91.00
Postulates for Arithmetic	18	45.00	10	91.00
The Real and Complex Number System	29	73.00	8	73.00
Averages	23	58.00	9	82.00

The data on the college teachers reveal that out of 11 participants, an average of 9 or 82.00 per cent have taken courses in foundation of mathematics.

A summary of the data revealed that some of the teachers are now realizing that foundations of mathematics are good review courses for advanced study in other higher mathematics.

Number of years on present job.--The data on the number of years the teachers have been employed on present job are presented in Table 13, page 32.

The data on the high school teachers reveal the number of years employed on present job as follows: 14 or 35.00 per cent have been

TABLE 13

DISTRIBUTION OF THE NUMBER OF YEARS ON PRESENT JOB BY THE TEACHERS

Years	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
1 - 3	14	35.00	3	28.00
4 - 6	11	28.00	1	9.00
7 - 9	6	15.00	4	36.00
10 - 12	4	10.00	0	0.00
13 - 15	3	7.00	1	19.00
Over 15 years	2	5.00	2	18.00
Totals	40	100.00	11	100.00

employed between 1 to 3 years; 11 or 28.00 per cent have been employed between 4 to 6 years; 6 or 15.00 per cent have been employed between 7 to 9 years; 4 or 10.00 per cent have been employed between 10 to 12 years; 3 or 7.00 per cent have been employed between 13 to 15 years; and 2 or 5.00 per cent have been employed over 15 years.

The data on the college teachers reveal the number of years on present job as follows: 3 or 28.00 per cent between 1 and 3 years; 1 or 9.00 per cent between 4 to 6 years; 4 or 36.00 per cent between 7 to 9 years; none or 0.00 per cent between 10 to 12 years; 1 or 9.00 per cent between 13 to 15 years; and 2 or 18.00 per cent over fifteen years.

A summary of the data revealed that since the school situation has improved in salary and building, the teachers do not find it necessary to change jobs every year. More people are now stable than ever.

Positions held by the teachers.--The data on the types of positions held by the teachers are presented in Table 14.

The data on the types of positions held by the high school teachers reveal that 15 or 38.00 per cent were Chairman of the Mathematics Department; and 23 or 57.00 per cent were teachers of mathematics.

TABLE 14

DISTRIBUTION OF POSITIONS HELD BY THE TEACHERS

Positions	High School Teachers		College Teachers	
	Distribution	Per Cent	Distribution	Per Cent
Chairman of Mathematics Department	15	38.00	4	36.00
Teacher of Mathematics	25	62.00		
Professor of Mathematics			0	0.00
Assistant Professor of Mathematics			4	36.00
Associate Professor of Mathematics			0	0.00
Instructor of Mathematics			3	28.00
Totals	40	100.00	11	100.00

The data on the college teachers reveal that 4 or 36.00 per cent were Chairman of Mathematics Departments; none or 0.00 per cent were Professor of Mathematics; 4 or 36.00 per cent were Assistant Professors of Mathematics; none or 0.00 per cent were Associate Professor of Mathematics; and 3 or 28.00 per cent were Instructors of Mathematics.

A summary of the data revealed that there were more high school teachers Chairmen of the Mathematics Department than college teachers. This was due to the fact that there are more high schools than colleges in the Metropolitan Atlanta area.

Certificates held by the high school teachers.--The data on the types of certificates held by the high school teachers are presented in Table 15.

TABLE 15

DISTRIBUTION OF CERTIFICATES HELD BY THE HIGH SCHOOL TEACHERS

Certificates	Distribution	Per Cent
T - 5	24	60.00
DT- 5	10	25.00
T - 6	0	0.00
B - 5	6	15.00
Totals	40	100.00

The data on the high school teachers reveal 24 or 60.00 per cent held T-5 certificate which represents five years of college work with the Master's degree; 10 or 25.00 per cent held DT-5 certificate which represents five years of college work with the Master's degree and nine years of experience; none or 0.00 per cent held the T-6 certificate which represents six years of college work with the Master's degree; and 6 or 15.00 per cent held the B-5 certificate which indicates that the individual has a degree but has not had enough professional education and/or content courses to obtain the professional certificate.

Below is a list of certificates as issued by the Georgia State Department of Education, Atlanta, Georgia, and explanation of the code:

B - Teacher's Provisional Certificate

T - Teacher's Professional Certificate

The prefix "D" means life certificate.

The numerical suffix indicates the number of years of recognized college credit.

A summary of the data revealed that a majority of the mathematics teachers received their degrees recently and have been adequately trained in the modern trends of mathematics. The type of their training is reflected through the objectives and the content of the mathematics program.

Subject familiar with the report of the College Entrance Examination Board.--The data on the high school and college teachers that are familar with the Report of the College Entrance Examination Board are presented in Table 16.

TABLE 16

DISTRIBUTION OF TEACHERS FAMILIAR WITH THE REPORT OF THE COLLEGE ENTRANCE EXAMINATION BOARD

	High School Teachers		College Teachers	
Responses	Distribution	Per Cent	Distribution	Per Cent
Yes	22	55.00	3	27.00
No	18	45.00	8	73.00
Totals	40	100.00	11	100.00

A summary of the data revealed that there were more high school

teachers familiar with the report of the College Entrance Examination Board than the college teachers. This could be due to the fact that most high school teachers are required to familiarize themselves with certain reports on mathematics, whereas college teachers are not required unless they want to.

Distribution of the question: Do you feel that the proposed program by the College Entrance Examination Board is appropriate for grades 9-12?.--The data on responses to the above question from the high school and college teachers are presented in Table 17.

TABLE 17

DISTRIBUTION OF THE QUESTION: DO YOU FEEL THAT THE PROPOSED PROGRAM BY THE COLLEGE ENTRANCE EXAMINATION BOARD IS APPROPRIATE FOR GRADES 9-12?

	High School Teachers		College Teachers	
Responses	Distribution	Per Cent	Distribution	Per Cent
Yes	27	68.00	5	45.00
No	0	0.00	0	0.00
No Response	13	32.00	6	55.00
Totals	40	100.00	11	100.00

The data on the high school teachers reveal that 27 or 68.00 per cent believed that the program proposed by the Board was appropriate; none or 0.00 per cent gave a negative response; and 13 or 32.00 per cent gave no response to the question.

The data on the college teachers reveal that 5 or 45.00 per cent believed that the proposed program was appropriate for grades 9-12;

none or 0.00 per cent gave a negative response; and 6 or 55.00 per cent gave no response to the question.

A summary of the data revealed that most of the high school teachers of this study believed that the program by the College Entrance Examination Board is appropriate for grades 9-12 while a high percentage of the college teachers gave no response. This could be due to the fact that since a high percentage of the college teachers were not familiar with the report, they could not express their opinions about the proposed program.

Mathematics course offerings for grades 9-12 for college preparation.--The data on the mathematics course offerings for grades 9-12 are presented in Table 18, page 38.

The data reveal that Algebra I is offered in the ninth grade by 6 schools or 40.00 per cent that participated in this study; tenth grade by 4 schools or 27.00 per cent; ninth and tenth grades by 3 schools or 20.00 per cent; ninth through twelfth grades by 2 schools or 13.00 per cent; and tenth through twelfth grades by 2 schools or 13.00 per cent. Algebra II is offered in the tenth grade by 6 or 40.00 per cent; and eleventh grade by 3 or 20.00 per cent.

Plane geometry is offered in the eleventh grade by 6 schools or 40.00 per cent; and twelfth grade by 2 schools or 13.00 per cent. Solid geometry is offered in the twelfth grade by 2 schools or 13.00 per cent. Trigonometry is offered in the twelfth grade by 6 schools or 40.00 per cent. General mathematics is offered in the ninth grade by 8 schools or 53.00 per cent; ninth and tenth grades by 4 or 27.00 per cent; and ninth through twelfth grades by 1 or 7.00 per cent. Advanced

TABLE 18

DISTRIBUTION OF MATHEMATICS COURSE OFFERINGS FOR GRADES 9-12 FOR COLLEGE PREPARATION

Courses	Grade Levels	Number of Schools	Per Cent
Algebra I	9	6	40.00
	10	4	27.00
	9-10	3	20.00
	9-12	2	13.00
	10-12	2	13.00
Algebra II	10	6	40.00
	11	3	20.00
Plane Geometry	11	6	40.00
	12	2	13.00
Solid Geometry	12	2	13.00
Trigonometry	12	6	40.00
General Mathematics	9	8	53.00
	9-10	4	27.00
	9-12	1	7.00
Advanced Algebra	11	2	13.00
	12	4	27.00
Analytical Geometry	11-12	1	7.00

algebra is offered in the eleventh grade by 2 schools or 13.00 per cent; and twelfth grade by 4 schools or 27.00 per cent. Analytical geometry is offered in the eleventh and twelfth grades by one school or 7.00 per cent.

A summary of the data revealed that, out of the fifteen schools that participated, each school is offering a well planned program in mathematics for college preparation. This is reflected from the

varieties of courses they are offering in the high schools.

General Objectives

Distribution of Teachers' opinions to general objectives of mathematics for grades 9-12.--The data on the general objectives of mathematics for grades 9-12 as indicated by the high school and college teachers are presented in Table 19, page 40, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on general objectives between the criteria-principles and the high school teacher's opinions about them ranged from a low of 24 or 60.00 per cent on the Item 1 to a high of 40 or 100.00 per cent for Items 2, 3, and 7. Other major ranking agreements were: 38 or 95.00 per cent for Item 4; 32 or 80.00 per cent for Item 6; 34 or 85.00 per cent for Item 8; 35 or 88.00 per cent for Item 5; and 39 or 98.00 per cent for Item 9.

Agreement Opinions of College Teachers - The agreement on general objectives between the criteria-principles and the college teacher's opinions ranked as follows: 11 or 100.00 per cent for Items 2, 3, 4, 5, 7, 8, and 9; 6 or 55.00 per cent for Item 1; and 9 or 82.00 per cent for Item 6.

Disagreement Opinions of High School Teachers - The disagreement on general objectives between the criteria-principles and the high school teachers ranged from a low of 7 or 2.00 per cent for Item 9 to a high of 16 or 40.00 per cent for Item 1. The other major ranking disagreements were: none or 0.00 per cent for Items 2, 3 and 7; 2 or 5.00 per cent on Item 4; 5 or 12.00 per cent on Item 5; 8 or 20.00

TABLE 19

DISTRIBUTION OF TEACHERS' OPINIONS TO GENERAL OBJECTIVES FOR GRADES 9-12

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. Provide strong preparation both in concepts and in skills for college mathematics at the level of calculus and geometry.	24	60.00	16	40.00	6	55.00	5	45.00
2. Provide an understanding of the nature and role of deductive reasoning in algebra as well as geometry.	40	100.00	0	0.00	11	100.00	0	0.00
3. Develop an appreciation of mathematical structure.	40	100.00	0	0.00	11	100.00	0	0.00
4. Provide judicious use of unifying ideas - sets, variables, functions, and relations.	38	95.00	2	5.00	11	100.00	0	0.00
5. Provide for incorporation with plane geometry some coordinate geometry, essentials of solid geometry and space perception.	35	88.00	5	12.00	11	100.00	0	0.00
6. Provide an introduction to fundamental geometry in grade 11 centered on coordinates, vectors and complex numbers.	32	80.00	8	20.00	9	82.00	2	18.00
7. Provide a basic foundation for elementary functions.	40	100.00	0	0.00	11	100.00	0	0.00
8. Provide for additional alternative units for grade 12.	34	85.00	6	15.00	11	100.00	0	0.00
9. Provide for treatment of inequalities along with equations.	39	98.00	1	2.00	11	100.00	0	0.00
Means	36	90.00	4	10.00	10	93.00	1	7.00
Per Cent of Difference			P_1-P_2 = 3.00%					
Standard Error of the Difference			P_1-P_2 = 9.00%					
Critical Ratio			"t" = .33					

per cent on Item 6; and 6 or 15.00 per cent on Item 8.

Disagreement Opinions of College Teachers - The disagreement on general objectives between the criteria-principles and the college teachers ranked as follows: 5 or 45.00 per cent for Items 1; 2 or 18.00 per cent for Item 6; and none or 0.00 per cent for Items 2, 3, 4, 5, 7, 8, and 9.

"t" Ratio of Comparison - Further, as shown in Table 19, the comparison of the opinions on general objectives of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 90.00 and 93.00 for the high school and college teachers, respectively, with a difference between the two per cents of 3.00. The standard error of the difference between the two per cents was 9.00. The "t" of .33 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the general objectives for grades 9-12 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the general objectives for grades 9-12 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the general objectives or end product to be achieved in a program of mathematics instruction.

Specific Objectives

Distribution of Opinions to specific objectives of mathematics for grade 9.--The data on the specific objectives of mathematics for grade 9 as indicated by the opinions of high school and college teachers are presented in Table 20, page 43, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific objectives between the criteria-principles and the high school teachers' opinions about them ranged from a low of 18 or 45.00 per cent for Item 2 to a high of 38 or 95.00 per cent for Item 1.

Agreement Opinions of College Teachers - The agreement on specific objectives between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for Item 1; and 8 or 73.00 per cent for Item 2.

Disagreement Opinions of High School Teachers - The disagreement on specific objectives between the criteria-principles and the high school teachers' opinions ranged from a low of 2 or 5.00 per cent for Item 1 to a high of 22 or 55.00 per cent for Item 2.

Disagreement Opinions of College Teachers - The disagreement on specific objectives between the criteria-principles and the college teachers ranked as follows: none or 0.00 per cent for Item 1; and 3 or 27.00 per cent for Item 2.

"t" Ratio of Comparison - Further, as shown in Table 20, the comparison of the opinions on specific objectives or mathematics as held by the two groups of teachers indicated the following: the per

TABLE 20

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC OBJECTIVES FOR GRADE 9

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. To develop in the student the ability to perform algebra manipulation.	38	95.00	2	5.00	11	100.00	0	0.00
2. To provide development and understanding of the properties of a number field.	18	45.00	22	55.00	8	73.00	3	27.00
Means	28	70.00	12	30.00	9	82.00	2	18.00
Per Cent of Difference	P_1-P_2 = 12.00%							
Standard Error of the Difference	P_1-P_2 = 14.00%							
Critical Ratio	"t" = .86							

cents of agreement were 70.00 and 82.00 for the high school and college teachers, respectively, with a difference between the two per cents of 12.00. The standard error of the difference between the two per cents was 14.00. The "t" of .86 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific objectives for grade 9 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific objectives for grade 9 of mathematics- education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the specific objectives or end product to be achieved in a program of mathematics instruction.

Distribution of opinions to specific objectives of mathematics for grade 10.--The data on the specific objectives of mathematics for grade 10 as indicated by the opinions of high school and college teachers are presented in Table 21, page 45, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific objectives between the criteria-principles and the high school teachers' opinions about them ranged from a low of 39 or 98.00 per cent for item 1 to a high of 40 or 100.00 per cent for Items 2 and 3.

TABLE 21

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC OBJECTIVES FOR GRADE 10

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. To develop acquisition of information about geometric figures in the plane and in the space.	39	98.00	1	2.00	11	100.00	0	0.00
2. To develop an understanding of the deductive method as a way of thinking and a reasonable skill in applying this method to mathematical situation.	40	100.00	0	0.00	11	100.00	0	0.00
3. To provide opportunities for original and creative thinking.	40	100.00	0	0.00	11	100.00	0	0.00
Means	39	99.00	1	1.00	11	100.00	0	0.00
Per Cent of Difference	P_1-P_2 = 1.00%							
Standard Error of the Difference	P_1-P_2 = 16.00%							
Critical Ratio	"t" = .06							

Agreement Opinions of College Teachers - The agreement on specific objectives between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for Items 1, 2, and 3.

Disagreement Opinions of High School Teachers - The disagreement on specific objectives between the criteria-principles and the high school teachers' opinions ranged from a low of none or 0.00 per cent for Items 2 and 3 to a high of 1 or 2.00 per cent for Item 1.

Disagreement Opinions of College Teachers - The disagreement on specific objectives between the criteria-principles and the college teachers' opinions ranked as follows: none or 0.00 per cent for Items 1, 2 and 3.

"t" Ratio of Comparison - Further, as shown in Table 21, the comparison of the opinions on specific objectives for grade 10 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 99.00 and 100.00 for the high school and college teachers, respectively, with a difference between the two per cents of 1.00. The standard error of the difference between the two per cents was 16.00. The "t" of .06 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific objectives for grade 10 of mathematics-education.

Further, there was not any apparent difference in the level of disagreement on the specific objectives for grade 10 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the specific objectives or end product to be achieved in a program of mathematics instruction.

Distribution of opinions to specific objectives of mathematics for grade 11.--The data on the specific objectives for grade 11 as indicated by the opinions of high school and college teachers are presented in Table 22, page 48, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific objectives between the criteria-principles and the high school teachers' opinions about them ranged from a low of 36 or 90.00 per cent for Item 2 to a high of 40 or 100.00 per cent for Item 1.

Agreement Opinions of College Teachers - The agreement on specific objectives between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for Item 2; and 7 or 64.00 per cent for Item 1.

Disagreement Opinions of High School Teachers - The diasgreement on specific objectives between the criteria-principles and the high school teachers' opinions ranged from a low of none or 0.00 per cent for Item 1 to a high of 4 or 10.00 per cent for Item 2.

Disagreement Opinions of College Teachers - The disagreement on specific objectives between the criteria-principles and the college

TABLE 22

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC OBJECTIVES FOR GRADE 11

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. To develop the essentials of algebra and trigonometry.	40	100.00	0	0.00	7	64.00	4	30.00
2. To provide the students with a key to understanding the numerical relationships involved in economics, psychology, biology, chemistry and other related fields.	36	90.00	4	10.00	11	100.00	0	0.00
Means	38	95.00	2	5.00	9	82.00	2	18.00
Per Cent of Difference	P_1-P_2 = 13.00%							
Standard Error of the Difference	P_1-P_2 = 12.00%							
Critical Ratio	"t" = 1.08							

teachers' opinions ranked as follows: 4 or 30.00 per cent for Item 1; and none or 0.00 per cent for Item 2.

"t" Ratio of Comparison - Further, as shown in Table 22, the comparison of the opinions on specific objectives for grade 11 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 95.00 and 82.00 for the high school and college teachers, respectively, with a difference between the two per cents of 13.00. The standard error of the difference between the two per cents was 12.00. The "t" of 1.08 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific objectives for grade 11 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific objectives for grade 11 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to held quite similar opinions about the specific objectives or end product to be achieved in a program of mathematics instruction.

Distribution of Opinions to specific objectives of mathematics for grade 12.--The data on the specific objectives of mathematics for grade 12 as indicated by the opinions of high school and college teachers are presented in Table 23, page 50, and are analyzed and interpreted below.

TABLE 23

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC OBJECTIVES FOR GRADE 12

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. To acquaint the students with certain functions that deepen the meaning in intermediate mathematics.	40	100.00	0	0.00	11	100.00	0	0.00
2. To promote genuine theoretical understanding.	34	85.00	6	15.00	11	100.00	0	0.00
3. To introduce the students to probability concepts and to the mathematics involved in these ideas.	38	95.00	2	5.00	11	100.00	0	0.00
4. To illustrate ways in which probability concepts apply to certain common statistical problems.	35	88.00	5	12.00	11	100.00	0	0.00
5. To make clear to the students that deductions are powerful means for organizing the subject matter of other branches of mathematics.	40	100.00	0	0.00	11	100.00	0	0.00
Means	37	94.00	3	6.00	11	100.00	0	0.00
Per Cent of Difference			P_1-P_2 = 6.00%					
Standard Error of the Difference			P_1-P_2 = 4.00%					
Critical Ratio			"t" = 1.50					

Agreement Opinions of High School Teachers - The agreement on specific objectives between the criteria-principles and the high school teachers' opinions about them ranged from a low of 34 or 85.00 per cent for Item 2 to a high of 40 or 100.00 per cent for Items 1 and 5. Other major ranking agreements were: 38 or 95.00 per cent for Item 3; and 35 or 88.00 per cent for Item 4.

Agreement Opinions of College Teachers - The agreement on specific objectives between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for Items 1, 2, 3, 4, and 5.

Disagreement Opinions of High School Teachers - The disagreement on specific objectives between the criteria-principles and the high school teachers ranged from a low of none or 0.00 per cent for Items 1 and 5 to a high of 6 or 15.00 per cent for Item 2. The other major ranking disagreements were: 5 or 12.00 per cent on Item 4; and 2 or 5.00 per cent for Item 3.

Disagreement Opinions of College Teachers - The disagreement on specific objectives between the criteria-principles and the college teachers opinions ranked as follows: none or 0.00 per cent for Items 1, 2, 3, 4, and 5.

"t" Ratio of Comparison - Further, as shown in Table 23, the comparison of the opinions on specific objectives for grade 12 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 94.00 and 100.00 for the high school and college teachers, respectively, with a difference between the two per cents of 6.00. The standard error of the difference

between the two per cents was 4.00. The "t" of 1.50 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific objectives for grade 12 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific objectives for grade 12 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to held quite similar opinions about the specific objectives or end product to be achieved in a program of mathematics instruction.

General Content

Distribution of teachers' opinions to general content of mathematics for grade 9.--The data on general content of mathematics for grade 9 as indicated by the opinions of high school and college teachers are presented in Table 24, page 53, and are analyzed and interpreted below.

Agreement opinions of High School Teachers - The agreement on general content between the criteria-principles and the high school teachers' opinions about them ranged from a low of 31 or 78.00 per cent for Item 8 to a high of 40 or 100.00 per cent each on Items 2, 3, 4, 5, 6, 7, 9, 11, and 12. Other major ranking agreements were: 39 or 98.00 per cent for Item 14; 34 or 85.00 per cent for Items 1 and 10; 33 or 82.00 per cent on Item 15; and 32 or 80.00 per cent on Item 13.

TABLE 24

DISTRIBUTION OF TEACHERS' OPINIONS TO GENERAL CONTENT FOR GRADE 9

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. Set theory.	34	85.00	6	15.00	11	100.00	0	0.00
2. Use of symbols.	40	100.00	0	0.00	11	100.00	0	0.00
3. Formulas.	40	100.00	0	0.00	11	100.00	0	0.00
4. Commutative, associative and distributive laws.	40	100.00	0	0.00	11	100.00	0	0.00
5. Postive and negative numbers.	40	100.00	0	0.00	11	100.00	0	0.00
6. Number scales and lines.	40	100.00	0	0.00	11	100.00	0	0.00
7. Concepts of equations and equalities.	40	100.00	0	0.00	11	100.00	0	0.00
8. Direct variation.	40	100.00	0	0.00	11	100.00	0	0.00
9. Linear equations and inequalities in one variable.	40	100.00	0	0.00	11	100.00	0	0.00
10. Linear equations and inequalities in two variables.	34	85.00	6	15.00	7	64.00	4	36.00
11. Polynomial expressions.	40	100.00	0	0.00	11	100.00	0	0.00
12. Rational expressions.	40	100.00	0	0.00	10	91.00	1	9.00
13. Informal deduction in algebra.	32	80.00	8	20.00	7	64.00	4	36.00
14. Quadratic equations.	39	98.00	1	2.00	10	91.00	1	9.00
15. Inverse variation.	33	82.00	7	18.00	11	100.00	0	0.00
Means	38	95.00	2	6.00	10	91.00	1	9.00
Per Cent of Difference		P_1-P_2 = 4.00%						
Standard Error of the Difference		P_1-P_2 = 9.00%						
Critical Ratio		"t" = .44						

Agreement Opinions of College Teachers - The agreement on general content between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for each of the 11 Items; 10 or 91.00 per cent for Items 12 and 14; and 7 or 64.00 per cent for Items 10 and 13.

Disagreement Opinions of High School Teachers - The disagreement on general content between the criteria-principles and the high school teachers ranged from a low of none or 0.00 per cent for Items 2, 3, 4, 5, 6, 7, 9, 11, and 12 to a high of 9 or 22.00 per cent for Item 8. The other major ranking disagreements were: 8 or 20.00 per cent for Item 13; 7 or 18.00 per cent for Item 15; 6 or 15 per cent for Item 10; and 1 or 2.00 per cent for Item 14.

Disagreement Opinions of College Teachers - The disagreements on general content between the criteria-principles and the college teachers ranked as follows: 4 or 36.00 per cent for Items 10 and 13; and 1 or 9.00 per cent for Items 12 and 14. The remaining 11 Items indicated no disagreement.

"t" Ratio of Comparison - Further, as shown in Table 24, the comparison of the opinions on general content for grade 9 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 91.00 and 95.00 for the high school and college teachers, respectively, with a difference between the two per cents of 4.00. The standard error of the difference between the two per cents was 9.00. The "t" of .44 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the general content for grade 9 mathematics-education. Further, there was not any apparent difference in the level of disagreement on the general content for grade 9 mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the general content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers' opinions to general content of mathematics for grade 10.--The data on general content of mathematics for grade 10 as indicated by the opinions of high school and college teachers are presented in Table 25, page 56, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on general content for grade 9 between the criteria-principles and the high school teachers' opinions about them ranged from a low of 30 or 75.00 per cent for Item 13 to a high of 40 or 100.00 per cent on Items 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12. Other major ranking agreements were: 38 or 95.00 per cent for Item 16; 36 or 90.00 per cent for Item 15 and 34 or 85.00 per cent for Items 2 and 14.

Agreement Opinions of College Teachers - The agreement on general content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for each of the 8 Items; 10 or 91.00 per cent for Items 4, 14, 15, and 16; 9

TABLE 25

DISTRIBUTION OF TEACHERS' OPINIONS TO GENERAL CONTENT FOR GRADE 10

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. The review of properties of common geometric figures.	40	100.00	0	0.00	11	100.00	0	0.00
2. Line segments and their measurements.	34	85.00	6	15.00	9	82.00	2	18.00
3. Angles and their measurements.	40	100.00	0	0.00	11	100.00	0	0.00
4. Deductive reasoning.	40	100.00	0	0.00	10	91.00	1	9.00
5. Sequence of theorems culminating in the Pythagorean Theorem.	40	100.00	0	0.00	7	64.00	4	36.00
6. Rectangle coordinates.	40	100.00	0	0.00	11	100.00	0	0.00
7. Direct line segment.	40	100.00	0	0.00	11	100.00	0	0.00
8. The mid-point formula.	40	100.00	0	0.00	11	100.00	0	0.00
9. Locus of an equation.	40	100.00	0	0.00	11	100.00	0	0.00
10. Equation of a straight line.	40	100.00	0	0.00	11	100.00	0	0.00
11. Equations of parallel and perpendicular lines.	40	100.00	0	0.00	9	82.00	2	18.00
12. Equation of a circle.	40	100.00	0	0.00	11	100.00	0	0.00
13. Locus in two and three dimensions.	30	75.00	10	25.00	8	73.00	3	27.00
14. Drawing of three-dimensional figures.	34	85.00	6	15.00	10	91.00	1	9.00
15. Angles between skew lines and planes.	36	90.00	4	10.00	10	91.00	1	9.00
16. Solid and plane figures.	37	93.00	3	7.00	10	91.00	1	9.00
Means	38	95.00	2	5.00	10	91.00	1	9.00
Per Cent of Difference		P_1-P_2 = 4.00%						
Standard Error of the Difference		P_1-P_2 = 9.00%						
Critical Ratio		"t" = .44						

or 82.00 per cent for Items 2 and 11; 8 or 73.00 per cent for Item 13; and 7 or 64.00 per cent for Item 5.

Disagreement Opinions of High School Teachers - The disagreement on general content materials between the criteria-principles and the high school teachers ranged from a low of none or 0.00 per cent for Items 1, 3, 4, 5, 6, 7, 8, 9, 10, 11, and 12 to a high of 10 or 25.00 per cent for Item 13. The other major ranking disagreements were: 6 or 15.00 per cent for Items 2 and 14; 4 or 10.00 per cent for Item 15; and 3 or 7.00 per cent for Item 16.

Disagreement Opinions of College Teachers - The disagreements on general content material between the criteria-principles and the college teachers ranked as follows: 3 or 27.00 per cent for Item 13; 2 or 18.00 per cent for Item 11; and 1 or 9.00 per cent for Items 4, 14, 15 and 16. The remaining 8 items indicated no disagreement on the items.

"t" Ratio of Comparison - Further, as shown in Table 25, the comparison of the opinions on general content for grade 10 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 91.00 and 95.00 for the high school and college teachers, respectively, with a difference between the two per cents of 4.00. The standard error of the difference between the two per cents was 9.00. The "t" of .44 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that

there was not any meaningful difference on the opinions held about the general content for grade 10 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the general content for grade 10 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the general content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers opinions to general content of mathematics for grade 11.--The data on the general content material of mathematics for grade 11, as indicated by the high school and college teachers, are presented in Table 26, page 59, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on general content materials between the criteria-principles and the high school teachers opinions about them ranged from a low of 29 or 73.00 per cent on Item 15 to a high of 40 or 100.00 per cent on the Items 2, 3, 4, 5, 6, and 7. Other major ranking agreements were: 37 or 93.00 per cent for Item 8; 36 or 90.00 per cent each for Items 1, 14, and 16.

Agreement Opinions of College Teachers - The agreement on general content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for each of the 14 Items; 10 or 91.00 per cent for Item 10; and 8 or 73.00 per cent for Item 11.

Disagreement Opinions of High School Teachers - The disagreement

TABLE 26

DISTRIBUTIONS OF TEACHERS' OPINIONS TO GENERAL CONTENT FOR GRADE 11

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. The development of number concepts.	36	90.00	4	10.00	11	100.00	0	0.00
2. Linear functions.	40	100.00	0	0.00	11	100.00	0	0.00
3. Ordered pairs and set of ordered pairs.	40	100.00	0	0.00	11	100.00	0	0.00
4. Radicals.	40	100.00	0	0.00	11	100.00	0	0.00
5. Quadratic equations (real and complex).	40	100.00	0	0.00	11	100.00	0	0.00
6. System of equations.	40	100.00	0	0.00	11	100.00	0	0.00
7. Exponents and logarithms.	40	100.00	0	0.00	11	100.00	0	0.00
8. Series.	37	93.00	3	7.00	11	100.00	0	0.00
9. Structural properties of rational, real and complex numbers.	33	82.00	7	18.00	11	100.00	0	0.00
10. Definition of plane vectors.	32	80.00	8	20.00	10	91.00	1	9.00
11. Multiplication by a scalar.	32	80.00	8	20.00	8	73.00	3	27.00
12. Parallelogram of vectors.	35	88.00	5	12.00	11	100.00	0	0.00
13. Vector triangles.	34	85.00	6	15.00	11	100.00	0	0.00
14. Sine, cosine, and tangent of a general angle defined in terms of x, y, and r.	36	90.00	4	10.00	11	100.00	0	0.00
15. Complex numbers as vectors.	29	73.00	11	27.00	11	100.00	0	0.00
16. Laws of sine and cosine.	36	90.00	4	10.00	11	100.00	0	0.00
Means	36	90.00	4	10.00	10	91.00	1	9.00
Per Cent of Difference		P_1-P_2 = 1.00%						
Standard Error of the Difference		P_1-P_2 = 10.00%						
Critical Ratio		"t" = .10						

on general content materials between the criteria-principles and the high school teachers ranged from a low of 3 or 7.00 per cent for Item 8 to a high of 11 or 27.00 per cent for Item 15. The other major ranking disagreements were: 8 or 20.00 per cent each for Item 10 and 11; 7 or 18.00 per cent on Item 9; 6 or 15.00 per cent on Item 13. The other Items of disagreement were: 4 or 10.00 per cent each for Items 1, 14, and 16; and 5 or 12.00 per cent for Item 12.

Disagreement Opinions of College Teachers - The disagreement on general content materials between the criteria-principles and the college teachers ranked as follows: 3 or 27.00 per cent for Item 11, and 1 or 9.00 per cent for Item 10. The remaining 14 Items indicated no disagreements.

"t" Ratio of Comparison - Further, as shown in Table 26, the comparison of the opinions on general content for grade 11 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 90.00 and 91.00 for the high school and college teachers, respectively, with a difference between the two per cents of 1.00. The standard error of the difference between the two per cents was 10.00. The "t" of .10 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the general content for grade 11 of mathematics-education. Further, there was not

any apparent difference in the level of disagreement on the general content for grade 11 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the general content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers' opinions to general content of mathematics for grade 12.--The data on the general content materials of mathematics for grade 12, as indicated by the high school and college teachers, are presented in Table 27, page 62, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on general content materials between the criteria-principles and the high school teachers' opinions about them ranged from a low of 32 or 80.00 per cent on Item 12 to a high of 40 or 100.00 per cent on the Items 2, 5, 6, 7, 8, 9, 15, and 19. Other major ranking agreements were: 39 or 98.00 per cent for Items 1 and 10; 38 or 95.00 per cent for Items 3, 13 and 18; 36 or 90.00 per cent for Item 14; and 35 or 88.00 per cent for Items 4, 11 and 17.

Agreement Opinions of College Teachers - The agreement on general content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for each of the 14 Items, 9 or 82.00 per cent each for Items 5, 10, and 12; and 8 or 73.00 per cent each for Items 11 and 14.

Disagreement Opinions of High School Teachers - The disagreement on general content materials between the criteria-principles and the

TABLE 27

DISTRIBUTION OF TEACHERS' OPINIONS TO GENERAL CONTENT FOR GRADE 12

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. The review and extension of concepts of sets.	39	98.00	1	2.00	11	100.00	0	0.00
2. Permutations and combinations.	40	100.00	0	0.00	11	100.00	0	0.00
3. Functions: definition, domain, graphical test, and methods of determining functions.	38	95.00	2	5.00	11	100.00	0	0.00
4. Relations: definition, domain, range and functions as a special kind of relation.	35	88.00	5	12.00	11	100.00	0	0.00
5. Mathematical induction.	40	100.00	0	0.00	9	82.00	2	18.00
6. Polynomial functions.	40	100.00	0	0.00	11	100.00	0	0.00
7. Exponential functions.	40	100.00	0	0.00	11	100.00	0	0.00
8. Logarithmic functions.	40	100.00	0	0.00	11	100.00	0	0.00
9. Circular functions.	40	100.00	0	0.00	11	100.00	0	0.00
10. The nature of probability and statistics.	39	98.00	1	2.00	9	82.00	2	18.00
11. The frequency of distribution.	35	88.00	5	12.00	8	73.00	3	27.00
12. The mean and standard deviation.	32	80.00	8	20.00	9	82.00	2	18.00
13. The binomial distribution.	38	95.00	2	5.00	11	100.00	0	0.00
14. Sampling from a finite population.	36	90.00	4	10.00	8	73.00	3	27.00
15. The system of rational numbers.	40	100.00	0	0.00	11	100.00	0	0.00
16. The system of real numbers under ordinary $+$ and $=$.	40	100.00	0	0.00	11	100.00	0	0.00
17. Axioms for ordered fields.	35	88.00	5	12.00	11	100.00	0	0.00
18. Examples of ordered fields.	38	95.00	2	5.00	11	100.00	0	0.00
19. Additional work on functions and relations.	40	100.00	0	0.00	11	100.00	0	0.00
Means	38	95.00	2	5.00	10	91.00	1	9.00
Per Cent of Difference		$P_1 - P_2$ = 4.00%						
Standard Error of the Difference		$P_1 - P_2$ = 9.00%						
Critical Ratio		"t" = .44						

high school teachers ranged from a low of 1 or 2.00 per cent for Items 1 and 10 to a high of 8 or 20.00 per cent for Item 12. The other major ranking disagreements were: 8 or 20.00 per cent for Item 21; 5 or 12.00 for Items 4, 11, and 17; 4 or 10.00 per cent for Item 4; and 2 or 5.00 per cent each for Items 3, 11, and 5. The remaining 9 Items indicated no disagreements on the Items.

Disagreement Opinions of College Teachers - The disagreement on general content materials between the criteria-principles and the college teachers ranked as follows: 3 or 27.00 per cent each for Items 5, 10, and 12. The remaining 14 Items indicated no disagreements on the Items.

"t" Ratio of Comparison - Further, as shown in Table 27, the comparison of the opinions on general content for grade 12 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 91.00 and 95.00 for the high school and college teachers, respectively, with a difference between the two per cents of 4.00. The standard error of the difference between the two per cents was 9.00. The "t" of .44 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the general content for grade 12 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the general content for grade 12 of mathematics-education as expressed by

the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the general content or end product to be achieved in a program of mathematics instruction.

Specific Content

Distribution of teachers' opinions to specific content of mathematics for grade 9.--The data on the specific content materials of mathematics for grade 9 as indicated by the high school and college teachers are presented in Table 28, page 65, and are analyzed and interpreted below.

Agreement of Opinions of High School Teachers - The agreement on specific content materials between the criteria-principles and the high school teachers' opinions about them ranged from a low of 33 or 82.00 per cent on Items 2 and 3 to a high of 40 or 100.00 per cent on Items 1, 4, 5, 6,7, 10, and 11. Other major ranking agreements were: 39 or 98,00 per cent for Item 8; 38 or 95.00 per cent for Item 12; and 36 or 90.00 per cent for Item 13.

Agreement Opinions of College Teachers - The agreement on specific content material between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for each of the 8 Items; 10 or 91.00 per cent for Item 13; 9 or 82.00 per cent for Item 8; and 8 or 73.00 per cent each for Items 2, 3, and 11.

Disagreement Opinions of High School Teachers - The disagreement on specific content material between the criteria-principles and the

TABLE 28

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC CONTENT FOR GRADE 9

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. $a + b = b + a$	40	100.00	0	0.00	11	100.00	0	0.00
2. $X^2 - 6X + 8 = 0$	33	82.00	7	18.00	8	73.00	3	27.00
3. $X^2 - 16 = 0$	33	82.00	7	18.00	8	73.00	3	27.00
4. $K = \frac{mv^2}{r}$	40	100.00	0	0.00	11	100.00	0	0.00
5. $\frac{4}{12^2y^2}$	40	100.00	0	0.00	11	100.00	0	0.00
6. $2(a + 3) = 2(a) + 2(3)$	40	100.00	0	0.00	11	100.00	0	0.00
7. $6x + 15 = 33$	40	100.00	0	0.00	11	100.00	0	0.00
8. $y = kx^3$	39	98.00	1	2.00	9	82.00	2	18.00
9. $y - 4 \leq 8$	40	100.00	0	0.00	11	100.00	0	0.00
10. $2 + 3 > 4$	40	100.00	0	0.00	11	100.00	0	0.00
11. $x > 3$	40	100.00	0	0.00	8	73.00	3	27.00
12. $\{ x/2 < x < 5 \}$	38	95.00	2	5.00	11	100.00	0	0.00
13. $/Z \div Z'/ - /Z/ + /Z'/$	36	90.00	4	10.00	10	91.00	1	9.00
Means	38	95.00	2	5.00	10	91.00	1	9.00
Per Cent of Difference		P_1-P_2 = 4.00%						
Standard Error of the Difference		P_1-P_2 = 9.00%						
Critical Ratio		"t" = .44						

high school teachers ranged from a low of 1 or 2.00 per cent for Item 8 to a high of 7 or 18.00 per cent each for Items 2 and 3. The other major ranking disagreements were: 4 or 10.00 per cent for Item 13; and 2 or 5.00 per cent for Item 12. The remaining 8 Items indicated no disagreements on the Items.

Disagreement on Opinions of College Teachers - The disagreement on specific content materials between the criteria principles and the college teachers ranked as follows: 3 or 27.00 per cent each for Items 2, 3, and 11; 2 or 18.00 per cent for Item 8; and 1 or 9.00 per cent for Item 13.

"t" Ratio of Comparison - Further, as shown in Table 28, the comparison of the opinions on specific content for grade 9 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 91.00 and 95.00 for the high school and college teachers, respectively, with a difference between the two per cents of 4.00. The standard error of the difference between the two per cents was 9.00. The "t" of .44 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific content for grade 9 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific content for grade 9 of mathematics-education as expressed by the high school and college teachers. Therefore, it

would appear that high school and college teachers tend to hold quite similar opinions about the specific content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers' opinions on specific content of mathematics for grade 10.--The data on the specific content material of mathematics for grade 10 as indicated by the opinions of high school and college teachers are presented in Table 29, page 68, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific content materials between the criteria-principles and the high school teachers' opinions about them ranged from a low of 12 or 30.00 per cent for Item 7 to a high of 40 or 100.00 per cent on Items 3, 4, 5, and 6. Other major ranking agreements were: 39 or 98.00 per cent for Item 2; and 38 or 95.00 per cent for Item 1.

Agreement Opinions of College Teachers - The agreement on specific content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent each for Items 1, 2, 3, 4, and 5; 8 or 73.00 per cent for Item 6; and 4 or 36.00 per cent for Item 7.

Disagreement Opinions of High School Teachers - The disagreement on specific content materials between the criteria-principles and the high school teachers' opinions ranged from a low of 1 or 2.00 per cent for Item 2 to a high of 28 or 70.00 per cent for Item 7. The other major ranking disagreement was: 2 or 5.00 per cent for Item 1. The remaining 4 Items indicated no disagreements on the Items.

TABLE 29

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC CONTENT FOR GRADE 10

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. $y = x^2 + 2x - 3$	38	95.00	2	5.00	11	100.00	0	0.00
2. $x^2 + y^2 = 25$	39	98.00	1	2.00	11	100.00	0	0.00
3. $P_1P_2 = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)}$	40	100.00	0	0.00	11	100.00	0	0.00
4. $PP_1 = \sqrt{(X - 5)^2 + (Y + 4)^2}$	40	100.00	0	0.00	11	100.00	0	0.00
5. $(x - h)^2 + (y - k)^2 = a^2$	40	100.00	0	0.00	11	100.00	0	0.00
6. $(x - 4)^2 + (y - 3)^2 = 25$	40	100.00	0	0.00	8	73.00	3	27.00
7. $\int x^2 \, dx$	12	30.00	28	70.00	4	36.00	7	64.00
Means	35	89.00	5	11.00	9	89.00	2	11.00
Per Cent of Difference		P_1-P_2 = 0.00%						
Standard Error of the Difference		P_1-P_2 = 10.00%						
Critical Ratio		"t" = .00						

Disagreement Opinions of College Teachers - The disagreement on specific content materials between the criteria-principles and the college teachers ranked as follows: 7 or 64.00 per cent for Item 7; and 3 or 27.00 per cent for Item 6. The remaining 5 Items indicated no disagreements on the items.

"t" Ratio of Comparison - Further, as shown in Table 29, the comparison of the opinions on specific content for grade 10 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 89.00 and 89.00 for the high school and college teachers, respectively, with a difference between the two per cents of 0.00. The standard error of the difference between the two per cents was 10.00. The "t" of .00 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific content for grade 10 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific content for grade 10 of mathematics-education, as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the specific content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers' opinions on specific content of mathematics for grade 11.--The data on specific content material of

mathematics for grade 11, as indicated by the opinions of high school and college teachers are presented in Table 30, page 71, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific content materials between the criteria-principles and the high school teachers' opinion about them ranged from a low of 36 or 10.00 per cent for Items 4 and 7 to a high of 40 or 100.00 per cent on Items 1 and 2. Other major ranking agreements were: 39 or 98.00 per cent for Item 5; 38 or 95.00 per cent for the Item 3 and 36 or 90.00 per cent for Items 4 and 7.

Agreement Opinions of College Teachers - The agreement on specific content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent each for Items 1, 2, 3, 4, 5, and 6; and 7 or 64.00 per cent for Item 7.

Disagreement Opinions of High School Teachers - The disagreement on specific content materials between the criteria-principles and the high school teachers' opinions ranged from a low of none or 0.00 per cent for the Items 1, 2, 3, 4, 5, and 6 to a high of 4 or 36.00 per cent for Item 7.

Disagreement Opinions of College Teachers - The disagreement on specific content materials between the criteria-principle and the college teachers ranked as follows: 4 or 36.00 per cent for Item 7. The remaining 6 Items indicated no disagreements.

"t" Ratio of Comparison - Further, as shown in Table 30, the comparison of the opinions on specific content for grade 11 of mathematics as held by the two groups of teachers indicated the following:

TABLE 30

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC CONTENT FOR GRADE 11

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. $y = mx + b$	40	100.00	0	0.00	11	100.00	0	0.00
2. $2 = 1 + \frac{1}{2} + \frac{1}{4} + \ldots + \frac{1}{2^{n-1}}$	40	100.00	0	0.00	11	100.00	0	0.00
3. $F = \{(x,y)/\ y = 2x + 3\}$	38	95.00	2	5.00	11	100.00	0	0.00
4. $\text{Tan } e = \frac{y}{x}$	36	90.00	4	10.00	11	100.00	0	0.00
5. $\text{Sin } e = \frac{1}{2}$	39	98.00	1	2.00	11	100.00	0	0.00
6. Prove that the square root of 2 is not a rational number.	38	95.00	2	5.00	11	100.00	0	0.00
7. $\frac{a}{0} = 0.\ a = 0$	36	90.00	4	10.00	7	64.00	4	36.00
Means	38	95.00	2	5.00	10	91.00	1	9.00
Per Cent of Difference		$P_1 - P_2$	=	4.00%				
Standard Error of the Difference		$P_1 - P_2$	=	9.00 %				
Critical Ratio		"t"	=	.44				

the per cents of agreement were 91.00 and 95.00 for the high school and college teachers, respectively, with a difference between the two per cents of 4.00. The standard error of the difference between the two per cents was 9.00. The "t" of .44 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific content for grade 11 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific content for grade 11 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the specific content or end product to be achieved in a program of mathematics instruction.

Distribution of teachers' opinion on specific content of mathematics for grade 12.--The data on specific content material of mathematics for grade 12, as indicated by the opinions of high school and college teachers are presented in Table 31, page 73, and are analyzed and interpreted below.

Agreement Opinions of High School Teachers - The agreement on specific content materials between the criteria-principles and the high school teachers' opinions ranged from a low of 23 or 58.00 per cent for the Items 2 and 8 to a high of 40 or 100.00 per cent for Items 1, 4, 5, 6, and 7. The other major ranking agreement was: 38

TABLE 31

DISTRIBUTION OF TEACHERS' OPINIONS TO SPECIFIC CONTENT FOR GRADE 12

Items	High School Teachers				College Teachers			
	Agree	Per Cent	Disagree	Per Cent	Agree	Per Cent	Disagree	Per Cent
1. $\begin{smallmatrix}1&2&3\\1&2&3\end{smallmatrix} + \begin{smallmatrix}1&2&3\\1&3&2\end{smallmatrix} = ?$	40	100.00	0	0.00	6	55.00	5	45.00
2. The graph of $R = \{(x,y)/\ y = x^2\}$	23	58.00	17	42.00	10	91.00	1	9.00
3. $y = a^x$	38	95.00	2	5.00	11	100.00	0	0.00
4. $y = \log_a X$	40	100.00	0	0.00	11	100.00	0	0.00
5. $Y = 6^2$	40	100.00	0	0.00	11	100.00	0	0.00
6. $\frac{0}{+3}, \frac{+5}{-3}$	40	100.00	0	0.00	11	100.00	0	0.00
7. $x^2 + y^2 = 13$	40	100.00	0	0.00	11	100.00	0	0.00
8. $a^2 = b^2 + c^2 - 2bc \cos A$	23	58.00	17	42.00	7	64.00	4	36.00
Means	35	89.00	5	11.00	9	89.00	2	11.00
Per Cent of Difference		P_1-P_2 = 0.00%						
Standard Error of the Difference		P_1-P_2 = 10.00%						
Critical Ratio		"t" = .00						

or 95.00 per cent for Item 3.

Agreement Opinions of College Teachers - The agreement on specific content materials between the criteria-principles and the college teachers' opinions ranked as follows: 11 or 100.00 per cent for Items 3, 4, 5, 6, and 7; 10 or 91.00 per cent for Item 2; 7 or 64.00 per cent for Item 8; and 6 or 55.00 per cent for Item 1.

Disagreement Opinions of High School Teachers - The disagreement on specific content material between the criteria-principles and the high school teachers' opinions ranged from a low of 2 or 5.00 per cent for Item 3 to a high of 17 or 42.00 per cent for Items 2 and 8.

The remaining 5 Items indicated no disagreements.

Disagreement Opinions of College Teachers - The disagreement on specific content materials between the criteria principles and the college teachers ranked as follows: 5 or 45.00 per cent for Item 1; 4 or 36.00 per cent for Item 8; and 1 or 91.00 per cent for Item 2. The remaining 5 Items indicated no disagreement.

"t" Ratio of Comparison - Further, as shown in Table 31, the comparison of the opinions on specific content for grade 12 of mathematics as held by the two groups of teachers indicated the following: the per cents of agreement were 89.00 and 89.00 for the high school and college teachers, respectively, with a difference between the two per cents of 0.00. The standard error of the difference between the two per cents was 10.00. The "t" of .00 was not significant for it was less than 2.58 at the .01 per cent level of confidence with 49 degrees of freedom.

Therefore, a summary of the above data will appear to

indicate, between the high school and college teachers of mathematics, that there was not any meaningful difference on the opinions held about the specific content for grade 12 of mathematics-education. Further, there was not any apparent difference in the level of disagreement on the specific content for grade 12 of mathematics-education as expressed by the high school and college teachers. Therefore, it would appear that high school and college teachers tend to hold quite similar opinions about the specific content or end product to be achieved in a program of mathematics instruction.

CHAPTER III

SUMMARY, CONCLUSIONS, IMPLICATIONS, AND RECOMMENDATIONS

The purpose of this chapter is to present the findings, conclusions, implications and recommendations derived from data collected from fifty-one secondary and college teachers of mathematics. These teachers were requested to give their opinions as to a proposed program of mathematics for secondary schools' students designed for college entrance.

Statement of the problem.--The problem involved in this study was to identify and analyze the opinions of a selected group of high school and college teachers of mathematics regarding a proposed modern college-preparatory mathematics program for grades nine through twelve.

Purpose of the study.--The major purpose of this study was to make a comprehensive analysis of the opinions held by high school and college teachers in the Metropolitan Atlanta area to the "new mathematics program."

More specifically, the purposes of this study were:

1. To determine what college preparatory courses are presently being offered in the schools in which the subjects taught in grade nine through twelve.

2. To ascertain the opinions held by a selected group of high school and college teachers regarding a proposed college-preparatory mathematics program for grades nine through twelve in terms of academic courses and objectives.

3. To identify the differences, if any, among the opinions held by the participating groups of subjects responding to the questionnaire.

4. To present the findings, derive conclusions and implications, and make recommendations pertaining to a new and modern college-preparatory mathematics program in the final thesis copy.

Locale and research-design of the study.--The significant aspects of the locale and research-design of this study are indicated below:

1. Locale and Period of Study: This study was conducted in Atlanta, Georgia during 1964.

2. Research Method: The Descriptive-Survey method of research, employing the techniques of the questionnaire and the interview, was used to gather the data necessary to the pursuit of this study.

3. Subjects: The subjects were a selected group of fifty high school teachers and thirteen college teachers employed in all of the high schools and colleges in the Metropolitan Atlanta area.

4. Materials: The basic data-gathering instrument was a specially designed questionnaire which was structured by compiling a set of criteria from the literature, submitting these criteria to a jury of experts, formulating the criteria into a set of questions, submission of the questionnaire to a jury, reformulating the questionnaire from their reactions, and submitting the questionnaire in its final form to a selected group of high school and college mathematics teachers in an effort to collect their opinions pertaining to a proposed program of college-preparatory mathematics at the high school level.

Procedural steps.--The data necessary to the development of this study were gathered, analyzed, interpreted, and presented through the following steps:

1. Permission to conduct this study was secured from the proper authorities.

2. The related literature pertinent to this study was reviewed,

summarized, and presented in the final thesis copy.

3. Questionnaires were prepared to collect the data.

4. The participants concerned in this study were contacted to secure their cooperation and to orientate them as to the nature and scope of the proposed research problem.

5. Copies of the questionnaire were distributed to all of the subjects who were to participate in this study.

6. The data were interpreted, analyzed, and assembled into appropriate tables in keeping with the nature and purpose of the study.

7. The findings, conclusions, implications and recommendations were formulated and incorporated in the final thesis copy.

Summary of the related literature.--The summarization and interpretation of the related literature pertinent to this research are presented in the statements to follow:

The Objectives of the New Mathematics Program

1. Mathematics objectives have been classified into two groups, the general mathematics objectives and the more specific mathematics objectives.

2. There seems to be general agreement upon the mathematics aims by mathematics experts.

3. Pressure from new social needs and demands on mathematical abilities of high school graduates have made it necessary to define the aims of mathematics as social and mathematical aims.

4. Complaints from college mathematic teachers have made it important to set up preparatory objectives for the modern mathematics program.

The Influence of National Organizations on the New Mathematics Program

1. In the last few decades there have appeared several important national committee's reports which have significantly affected the content and organization of the modern mathematics program

in the high schools.

2. The first report which was issued in 1923, by the National Committee furnished important leadership for the future direction of mathematics-education in the United States and provided teachers with an account of the latest developments in certain aspects of mathematics-education.

3. In 1940, there appeared the report of the Joint Commission of the Mathematics Association of America, The Commission on the Secondary School Curriculum of the Progressive Education Association and the National Council of Teachers of Mathematics which prepared reports that dealt with the objectives and content that should be utilized in the high schools.

4. In 1959, the Commission on Mathematics of the College Entrance Examination Board issued a two-part report on the secondary mathematics program for college-bound students.

5. The Rockefeller's Report has had the greatest influence on the high school mathematics program since it contains an account of the automation revolution, the accompanying long-term in the demand for highly educated mathematicians and the crisis that confront the nation.

Summary of Findings

The quantitative measures of the basic findings of this research have been presented in Tables 1 through 31.

Questionnaires Distributed and Returned
Table 1

Out of the fifty questionnaires distributed to the high school teachers, 40 or 80.00 per cent were returned. For the college teachers, out of the thirteen distributed, 11 or 84.00 per cent were returned. Out of a total of sixty-three questionnaires distributed for both groups, 51 or 82.00 per cent were returned.

Sex of the Teachers
Table 2

On the sex of the high school teachers, 33 or 58.00 per cent were males and 17 or 42.00 per cent were females. The respondents

from the college teachers indicated that 7 or 42.00 per cent were males and 4 or 36.00 per cent were females.

Level of Training of the Teachers
Table 3

On the level of training of the high school teachers, the data revealed that 14 or 35.00 per cent held the Master of Science degree; 3 or 7.00 per cent held the Master of Arts degree; 1 or 3.00 per cent held the Master of Science degree and were doing further study toward the Doctoral degree; 1 or 3.00 per cent held the Master of Arts degree and were doing further study toward the six-year certificate; 6 or 15.00 per cent held the Master of Science degree and were doing further study toward self-improvement; 6 or 15.00 per cent held the Master of Science degree and were doing further study toward the six-year certificate; 3 or 7.00 per cent held the Master of Science and Master of Arts degrees and were doing further study toward self-improvement and the six-year certificate. The data on the level of training of the college teachers indicated that 3 or 27.00 per cent held the Master of Science degree; none or 0.00 per cent held the Master of Arts degree; 4 or 37.00 per cent held the Master of Science degree and were doing further study toward the Doctoral degree; 2 or 18.00 per cent held the Doctor of Philosophy degree; none or 0.00 per cent held the Doctor of Education degree; and 2 or 18.00 per cent held two Master of Science degrees.

Institutions Which Conferred Degrees on the Teachers
Table 4

The data on the institutions where degrees were conferred on the high school teachers revealed that 31 or 78.00 per cent received the Master's degree from Atlanta University; and 9 or 22.00 per cent received the Master's degree from other institutions. The data for the college teachers revealed that 7 or 64.00 per cent received the Master's degree from Atlanta University; and 4 or 36.00 per cent received the Master's degree from other institutions.

Number of Years of Study of the Teachers
Table 5

The data revealed, for both high school and college teachers, that 36 or 90.00 per cent, and 7 or 62.00 per cent received their degrees between 1 and 2 years, respectively.

Degree Held by the Teachers
Table 6

The data revealed that the highest percentage of the high school and college teachers held the Master of Science degree which were 27 or 68.00 per cent, and 7 or 64.00 per cent, respectively.

Fields of Study of the Teachers
Table 7

The data for the high school and college teachers revealed that a majority of both groups received their degrees in pure mathematics, which were 27 or 68.00 per cent, and 10 or 91.00 per cent for both groups, respectively.

Courses in Analysis Taken by the Teachers
Table 8

The data revealed that the high school teachers have taken an average of 37 or 86.00 per cent of the courses listed in analysis while the college teachers have taken an average of 9 or 84.00 per cent of the courses listed in analysis.

Courses in Application Taken by the Teachers
Table 9

The data on the high school teachers revealed that an average of 6 or 14.00 per cent have taken some type of courses in applications. The data on the college teachers revealed that an average of 3 or 24.00 per cent have taken courses in applications.

Courses in Algebra Taken by the Teachers
Table 10

The data on the high school teachers revealed that an average of 32 or 80.00 per cent have taken courses in algebra. The data on the college teachers revealed that an average of 10 or 98.00 per cent have taken courses in algebra.

Courses in Geometry Taken by the Teachers
Table 11

The data on the high school teachers revealed that an average of 22 or 55.00 per cent have taken courses in geometry. The data on the college teachers revealed that an average of 8 or 73.00 per cent have taken courses in geometry.

Courses in Foundations of Mathematics Taken by the Teachers
Table 12

The data on the high school teachers revealed that an average of 23 or 58.00 per cent have taken courses in foundations of mathematics while the data on the college teachers revealed that an average of 9 or 82.00 per cent have taken courses in foundations of mathematics.

Number of Years on Present Job
Table 13

The data revealed that the highest percentage of the high school teachers had been on their present job between 1 and 3 years which were 14 or 35.00 per cent. The data on the college teachers revealed that the highest percentage had been on their present job between 7 and 9 years which were 4 or 36.00 per cent.

Position Held by the Teachers
Table 14

The data revealed that the majority of the high school teachers were teachers of mathematics while the majority of the college teachers were Chairmen of the Mathematics Department.

Certificates Held by the High School Teachers
Table 15

The data revealed that a majority of the high school teachers held professional five-year certificates which represent five years of college work with the Master's degree.

Subjects Familiar with the Report of the
College Entrance Examination Board
Table 16

The data revealed that the majority of the high school teachers were familiar with the report while only a small per cent of the college teachers were familiar with the report of the College Entrance Examination Board.

Distribution of the Question: Do You Feel that the
Proposed Program by the College Entrance Examination Board is Appropriate for Grades
9-12?
Table 17

The data revealed that most of the high school teachers believed

that the program by the College Entrance Examination Board were appropriate for grades 9-12 while the majority of the college teachers gave no response to the question.

Mathematics Course Offerings for Grades 9-12
for College Preparation
Table 18

The data revealed that out of the fifteen schools that participated, each school was offering a well planned program in mathematics for college preparation.

Teachers' Opinions Toward General Objectives
In Grades 9-12
Table 19

On the variable of teachers' opinions on general objectives for mathematics in grades 9-12, the data revealed the following:

Agreement - The extent of agreement on the general objectives was indicated by mean per cents of 90.00 and 93.00 for high school and college teachers, respectively with a difference between the per cents of 3.00, a standard error of the difference of 9.00, and a "t" of .33 which was not significant.

Disagreement - The extent of disagreement on the general objectives was indicated by mean per cents of 7.00 and 10.00 for the high school and college teachers, respectively, with a difference between the per cents of 3.00, a standard error of the difference of 9.00, and a "t" of .33 which was not significant.

Teachers' Opinions Toward Specific
Objectives in Grade 9
Table 20

On the variable of teachers' opinions on specific objectives for mathematics in grade 9, the data revealed the following:

Agreement - The extent of agreement on the specific objectives was indicated by mean per cents of 70.00 and 82.00 for high school and college teachers, respectively, with a difference between the per cents of 12.00, a standard error of the difference of 14.00, and a "t" of .86 which was not significant.

Disagreement - The extent of disagreement on the specific objectives was indicated by mean per cents of 18.00 and 30.00 for the high school and college teachers, respectively, with a difference between the per cents of 12.00, a standard error of the difference of 14.00, and a "t" of .86 which was not significant.

Teachers' Opinions Toward Specific
Objectives in Grade 10
Table 21

On the variable of teachers' opinions on specific objectives for mathematics in grade 10, the data revealed the following:

Agreement - The extent of agreement on the specific objectives was indicated by mean per cents of 99.00 and 100.00 for high school and college teachers, respectively, with a difference between the per cents of 1.00, a standard error of the difference of 16.00, and a "t" of .06 which was not significant.

Disagreement - The extent of disagreement on the specific objectives was indicated by mean per cents of 0.00 and 1.00 for the high school and college teachers, respectively, with a difference between the per cents of 1.00, a standard error of the difference of 16.00, and a "t" of .06 which was not significant.

Teachers' Opinions Toward Specific
Objectives in Grade 11
Table 22

On the variable of teachers' opinions on specific objectives for mathematics in grade 11, the data revealed the following:

Agreement - The extent of agreement on the specific objectives was indicated by mean per cents of 82.00 and 95.00 for high school and college teachers, respectively, with a difference between the per cents of 13.00, a standard error of the difference of 12.00, and a "t" of 1.08 which was not significant.

Disagreement - The extent of disagreement on the specific objectives was indicated by mean per cents of 5.00 and 18.00 for the high school and college teachers, respectively, with a difference between the per cents of 13.00, a standard error of the difference of 12.00, and a "t" of 1.08 which was not significant.

Teachers' Opinions Toward Specific
Objectives in Grade 12
Table 23

On the variable of teachers' opinions on specific objectives for mathematics in grade 12, the data revealed the following:

Agreement - The extent of agreement on the specific objectives was indicated by mean per cents of 94.00 and 100.00 for high school and college teachers, respectively, with a difference between the per cents of 6.00, a standard error of the difference of 4.00, and a "t" of 1.50 which was not significant.

Disagreement - The extent of disagreement on the specific objectives was indicated by mean per cents of 0.00 and 6.00 for the high school and college teachers, respectively, with a difference

between the per cents of 6.00, a standard error of the difference of 4.00, and a "t" of 1.50 which was not significant.

Teachers' Opinions Toward General
Content in Grade 9
Table 24

On the variable of teachers' opinions on general content for mathematics in grade 9, the data revealed the following:

Agreement - The extent of agreement on the general content was indicated by a mean per cent of 91.00 and 94.00 for high school and college teachers, respectively, with a difference between the per cents of 3.00, a standard error of the difference of 9.00, and a "t" of .33 which was not significant.

Disagreement - The extent of disagreement on the general content was indicated by a mean per cent of 6.00 and 9.00 for the high school and college teachers, respectively, with a difference between the per cents of 3.00, a standard error of the difference of 9.00, and a "t" of .33 which was not significant.

Teachers' Opinions Toward General
Content in Grade 10
Table 25

On the variable of teachers' opinions on general content for mathematics in grade 10, the data revealed the following:

Agreement - The extent of agreement on the general content was indicated by a mean per cent of 92.00 and 95.00 for high school and college teachers, respectively, with a difference between the per cents of 3.00, a standard error of the difference of 8.00, and a "t" of .38 which was not significant.

Disagreement - The extent of disagreement on the general content was indicated by a mean per cent of 5.00 and 8.00 for the high school and college teachers, respectively, with a difference between the per cents of 3.00, a standard error of the difference of 8.00, and a "t" of .38 which was not significant.

Teachers' Opinions Toward General
Content in Grade 11
Table 26

On the variable of teachers' opinions on general content for mathematics in grade 11, the data revealed the following:

Agreement - The extent of agreement on the general content was indicated by mean per cents of 90.00 and 91.00 for high school and college teachers, respectively, with a difference between the per cents of 1.00, a standard error of the difference of 10.00, and a

"t" of .10 which was not significant.

Disagreement - The extent of disagreement on the general content was indicated by mean per cents of 9.00 and 10.00 for the high school and college teachers, respectively, with a difference between the per cents of 1.00, a standard error of the difference of 10.00, and a "t" of .10 which was not significant.

Teachers' Opinions Toward General
Content in Grade 12
Table 27

On the variable of teachers' opinions on general content for mathematics in grade 12, the data revealed the following:

Agreement - The extent of agreement on the general content was indicated by mean per cents of 91.00 and 95.00 for high school and college teachers, respectively, with a difference between the per cents of 4.00, a standard error of the difference of 9.00, and a "t" of .44 which was not significant.

Disagreement - The extent of disagreement on the general content was indicated by mean per cents of 5.00 and 9.00 for the high school and college teachers, respectively, with a difference between the per cents of 4.00, a standard error of the difference of 9.00, and a "t" of .44 which was not significant.

Teachers' Opinions Toward Specific
Content in Grade 9
Table 28

On the variable of teachers' opinions on specific content for mathematics in grade 9, the data revealed the following:

Agreement - The extent of agreement on the specific content was indicated by mean per cents of 91.00 and 95.00 for high school and college teachers, respectively, with a difference between the per cents of 4.00, a standard error of the difference of 9.00, and a "t" of .44 which was not significant.

Disagreement - The extent of disagreement on the specific content was indicated by mean per cents of 5.00 and 9.00 for the high school and college teachers, respectively, with a difference between the per cents of 4.00, a standard error of the difference of 9.00, and a "t" of .44 which was not significant.

Teachers' Opinions Toward
Specific Content in
Grade 10
Table 29

On the variable of teachers' opinions on specific content for

mathematics in grade 10, the data revealed the following:

Agreement - The extent of agreement on the specific content was indicated by mean per cents of 89.00 and 89.00 for high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 1.02, and a "t" of .00 which was not significant.

Disagreement - The extent of disagreement on the specific content was indicated by mean per cents of 11.00 and 11.00 for the high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 1.02, and a "t" of .00 which was not significant.

Teachers' Opinions Toward Specific Content in Grade 11
Table 30

On the variable of teachers' opinions on specific content for mathematics in grade 11, the data revealed the following:

Agreement - The extent of agreement on the specific content was indicated by mean per cents of 95.00 for high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 7.00, and a "t" of .00 which was not significant.

Disagreement - The extent of disagreement on the specific content was indicated by mean per cents of 5.00 and 5.00 for the high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 7.00, and a "t" of .00 which was not significant.

Teachers' Opinions Toward Specific Content in Grade 12
Table 31

On the variable of teachers' opinions on specific content for mathematics in grade 12, the data revealed the following:

Agreement - The extent of agreement on the specific content was indicated by a mean per cent of 89.00 and 89.00 for high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 10.00, and a "t" of .00 which was not significant.

Disagreement - The extent of disagreement on the specific content was indicated by a mean per cent of 11.00 and 11.00 for the high school and college teachers, respectively, with a difference between the per cents of 0.00, a standard error of the difference of 10.00, and a "t" of .00 which was not significant.

Conclusions.--The findings of this study appear to warrant the following conclusions:

1. The respondents were highly competent and qualified to make the mature judgments required by the data-gathering instrument, the problem and the purposes of the study.

2. The college preparatory courses presently being offered in the high schools in which the subjects taught appear to meet the criteria for college preparation which the experts proposed.

3. The high school and college teachers who participated in this study did not differ significantly in terms of their acceptance of the proposed academic courses and objectives from the proposals of the authorities in mathematics and mathematics-education for a college-preparatory mathematics program for grades nine through twelve.

4. There were no significant differences on their disagreements between the two groups. The two groups were consistent in their responses in all areas of the questionnaire; moreover, the disagreements were not significant in terms of possible implications for deviations in structure-objectives of the college-preparatory program in mathematics.

Implications.--The implications of this study are as follows:

1. The present program of mathematics in the schools in which the respondents work is in essential agreement with the college-preparatory mathematics courses which the authorities proposed for grade nine through twelve.

2. In view of the fact that the majority of both the high school and college teachers involved in this study were Atlanta University's graduates, it appears justifiable to say that the program of mathematics and mathematics-education at this institution is adequate in terms of preparation for a modern mathematics-education program.

Recommendations.--It is recommended:

1. That another study be made in this area using teachers from a less sophisticated area.

2. That, since the teachers have a broad knowledge of the new mathematics program, the teachers included in this study should continue their in-service program in order to maintain up-to-date information on the new mathematics program.

3. That more of the college teachers in mathematics take advantage of the grants offered in mathematics to complete the requirements for the Doctoral degree.

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VITA

Reynolds, Sweetie S.

Education:

B. S., Morris Brown College, 1962, Atlanta, Georgia. Major - Mathematics and Secondary Education.

Experience:

Mathematics teacher, Washington Street High School, Quitman, Georgia, 1962-1963 and Central High School, Newnan, Georgia, 1964 - present.

Graduate Field of Concentration:

Mathematics-Education

Personal Information:

Single, member of Sigma Gamma Rho Sorority, Young Women's Christian Association, National Education Association and Saint Paul of the Cross Catholic Church, Atlanta, Georgia.

APPENDIX A

APPENDIX A

2063 Chicago Avenue, N. W.
Atlanta, Georgia 30314
May 7, 1964

Dear Sir:

I am conducting a research study for a Master's degree at Atlanta University, Atlanta, Georgia. My topic is entitled "Opinions Regarding a Modern Mathematics Program for the Secondary Schools." I urgently request your cooperation in collecting data by completing the enclosed questionnaire.

This questionnaire has been devised so as to require a minimum of writing and time. All you have to do is to read each item and respond to each item by placing a check (v) in the space provided to the right of each item.

When this questionnaire has been properly executed, please return it to me by the enclosed self-addressed and stamped envelope. It is not necessary for you to sign your name.

Thank you very much for your time and consideration.

Very truly yours,

/s/ (Miss) Sweetie S. Reynolds

SSR

APPENDIX B

APPENDIX B

For High School Teachers

Part I

Personal Information

Please indicate the appropriate responses in the space provided.

1. Check your sex:

___Male ___Female

2. Indicate your training below: (check)

_____ Master of Science Degree

_____ Master of Arts Degree

_____ Further study beyond Master's degree toward self-improvement

_____ Further study beyond Master's degree toward doctoral degree

_____ Further study beyond Master's degree toward six year certificate

_____ Other: (specify)

_____

3. Where did you do your graduate work: (write on lines below)

Institution (s)	Year (s) of Study	Degree (s) Received	Field (s) of Study
_____	_____	_____	_____
_____	_____	_____	_____
_____	_____	_____	_____

4. Please check the mathematics courses you have had by using the following list:

A. Analysis

_____ Trigonometry

_____ Plane Analytical Geometry

_____ Calculus

_____ Solid Analytic Geometry

_____ Advanced Calculus

_____ Differential Equations

_____ Infinite Series

B. Applications

_____ Mechanics (Statics or Dynamics)

_____ Mathematical Physics

_____ Mathematical Astronomy

_____ Acturial Mathematics (finite, differences, interpolation, numerical analysis)

C. Algebra

_____ Abstract Algebra (fields, rings, groups, linear algebra, vector spaces)

_____ Matrices

_____ Theory of Numbers

_____ Theory of Equations

D. Geometry

_____ Metric and other geometries (projective, affine, inversive)

_____ Non-Euclidean geometries

_____ Differential geometry

_____ Topology

E. Foundation of Mathematics

_____ Theory of Sets

_____ Mathematical or Symbolic Logic

_____ Postulates for Geometry

_____ Postulates for Algebra

_____ Postulates for Arithmetic

_____ The Real and Complex Number System

5. Check the type (s) of position (s) you now hold below:

_____ Chairman of Mathematics Department

_____ Teacher of Mathematics

Other: (specify)

_____

_____

6. Indicate the number of years you have been employed on your present job by circling one number below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 Over 15 years

7. Please check the types of certificate you now hold in the field of mathematics below:

____ T-5 ____ DT-5

____ T-6 ____ B-5

Other: (specify)

_____

_____

8. Are you familiar with the Report of the Commission on Mathematics of the College Entrance Examination Board entitled "Program for College Preparatory Mathematics?" (check)

____ Yes ____ No

9. Do you feel that the proposed mathematics program for college-capable students issued by the College Entrance Examination Board is appropriate for grades 9-12? (Check) ____ Yes ____ No

10. List the mathematics courses offered in your school in the grades below for college preparation: (for the Chairman of the Mathematics Department only)

9th _____ _____ 10th _____ _____

11th _____ _____ 12th _____ _____

For College Teachers

Part I

Personal Information

Please indicate the appropriate responses in the space provided.

1. Check your sex:

____ Male ____ Female

2. Indicate your training below: (check)

_____ Master of Science Degree

_____ Master of Arts Degree

_____ Further study beyond Master's degree toward Doctoral degree

_____ Further study beyond Master's degree toward self-improvement

_____ Doctor of Philosophy Degree

_____ Doctor of Education Degree

_____ Further study beyond Doctoral degree

3. Where did you do your graduate work? (write on lines below)

Institution (s)	Year (s) of Study	Degree (s) Received	Field (s) of Study

4. Please check the mathematics courses you have had by using the following list:

A. Analysis

_____ Basic functions of Analysis

_____ Infinite Series

_____ Fourier Series and Integrals

_____ Solid Analytic Geometry

_____ Advanced Calculus

_____ Differential Equations

B. Applications

_____ Mechanics (Statics or Dynamics)

_____ Mathematical Physics

_____ Mathematical Astronomy

_____ Acturial Mathematics (finite, differences, interpolation, numerical analysis)

C. Algebra

_____ Abstract Algebra (fields, rings, groups, linear algebra, vector spaces)

_____ Matrices

_____ Theory of Numbers

_____ Theory of Equations

D. Geometry

_____ Metric and other geometries (projective, affine, inversive)

_____ Non-Euclidean geometries

_____ Topology

_____ Concepts of Global Geometry

E. Foundations of Mathematics

_____ Theory of Sets

_____ Mathematical or Symbolic Logic

_____ Postulates for Geometry

_____ Postulates for Algebra

_____ Postulates for Arithmetic

_____ The Real and Complex Number System

5. Check the type (s) of position (s) you now hold below:

_____ Chairman of Mathematics Department

_____ Professor of Mathematics

_____ Assistant Professor of Mathematics

_____ Associate Professor of Mathematics

_____ Instructor of Mathematics

Other (specify)

_____

_____

6. Indicate the number of years you have been employed on present job by circling one number below:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18

19 20 21 22 23 24 25 Over 25 years

7. Are you familiar with the Report of the Commission on Mathematics of the College Entrance Examination Board entitled "Program for College Preparatory Mathematics?" (check)

____ Yes ____ No

8. Do you feel that the proposed mathematics program for college-capable students issued by the College Entrance Examination Board is appropriate for grades 9-12? (check)

____ Yes ____ No

For High School and College Teachers

Part II

General Considerations

In this section general and specific objectives, proposed content, and specific topics are presented as "suggested" for a college- preparatory sequence for grades 9-12. If you are in agreement or disagreement with the objectives and content for the courses listed, please check (v) on the lines under A (agree) of D (disagree). Remember to check each.

General Objectives

A college-preparatory course in mathematics for grades 9-12 should:	A	D
1. Provide strong preparation both in concepts and in skills for college mathematics at the level of calculus and geometry.	—	—
2. Provide an understanding of the nature and role of deductive reasoning in algebra as well as geometry.	—	—
3. Develop an appreciation of mathematical structure.	—	—
4. Provide judicious use of unifying ideas--sets, variables, functions and relations.	—	—
5. Provide for incorporation with plane geometry some coordinate geometry, essentials of solid geometry and space perception.	—	—
6. Provide an introduction to fundamental geometry in grades 11 centered on coordinates, vectors and complex numbers.	—	—
7. Provide a basic foundation for elementary functions.	—	—
8. Provide for additional alternative units for grade 12	—	—
9. Provide for treatment of inequalities along with equations.	—	—

Specific Objectives

	A	D
Mathematics for grade 9 (Elementary Mathematics or Algebra I) should be:		
1. To develop in the students the ability to perform algebraic manipulation.	___	___
Mathematics for grade 10 (Elementary Mathematics II or Plane and Solid Geometry) should be:		
1. To develop acquisition of information about geometric figures in the plane and in the space.	___	___
2. To develop an understanding of the deductive method as a way of thinking and a reasonable skill in applying this method to mathematical situations.	___	___
3. To provide opportunities for original and creative thinking.	___	___
Mathematics for grade 11 (Intermediate Mathematics or Algebra II and Trigonometry) should be:		
1. To develop the essentials of algebra and trigonometry.	___	___
2. To provide the students with a key to understanding the numberical relationships involved in economics, psychology, biology, chemistry and other related fields.	___	___
Mathematics for grade 12 (Elementary Functions and Introductory Probability with Statistical Applications or Modern Algebra) should be:		
1. To acquaint the students with certain functions that deepen the meaning in intermediate mathematics.	___	___
2. To promote genuine theoretical understanding.	___	___
3. To introduce the students to probability concepts and to the mathematics involved in these ideas.	___	___
4. To illustrate ways in which probability concepts apply to certain common statistical problems.	___	___

5. To make clear to the students that deductions are powerful means for organizing the subject matter of other branches of mathematics. — —

Content

	A	D
Content in mathematics for grade 9 should include:		
1. Set theory.	—	—
2. Use of symbols.	—	—
3. Formulas.	—	—
4. Commutative, associative and distributive laws.	—	—
5. Positive and negative numbers.	—	—
6. Number scales and lines.	—	—
7. Concepts of equations and equalities.	—	—
8. Direct variation.	—	—
9. Linear equations and inequalities in one variable.	—	—
10. Linear equations and inequalities in two variable.	—	—
11. Polynomial expressions.	—	—
12. Rational expressions.	—	—
13. Informal deduction in algebra.	—	—
14. Quadratic equations.	—	—
15. Inverse variation.	—	—
Content in mathematics for grades 10 should include:		
1. The review of properties of common geometric figures.	—	—
2. Line segments and their measurements.	—	—
3. Angles and their measurements.	—	—
4. Deductive reasoning.	—	—
5. Sequence of theorems culminating in the Pythagorean Theorem.	—	—

6. Rectangle coordinates. ___ ___
7. Direct line segment. ___ ___
8. The mid-point formula. ___ ___
9. Locus of an equation. ___ ___
10. Equation of a straight line. ___ ___
11. Equations of parallel and perpendicular lines. ___ ___
12. Equation of a circle. ___ ___
13. Locus in two and three dimensions. ___ ___
14. Drawing of three-dimensional figures. ___ ___
15. Angles between skew lines and planes. ___ ___
16. Solid and plane figures. ___ ___

Content in mathematics for grades 11 should include:

1. The development of number concepts. ___ ___
2. Linear functions. ___ ___
3. Ordered pairs and set of ordered pairs. ___ ___
4. Radicals. ___ ___
5. Quadratic equations (real and complex). ___ ___
6. System of equations. ___ ___
7. Exponents and logarithms. ___ ___
8. Series. ___ ___
9. Structural properties of rational, real and complex numbers. ___ ___
10. Definition of plane vectors. ___ ___
11. Multiplication by a scalar. ___ ___
12. Parallelogram of vectors. ___ ___
13. Vector triangles. ___ ___

14. Sine, cosine, and tangent of a general angle defined in terms of x, y, and r. ___ ___

15. Complex numbers as vectors ___ ___

16. Laws of sine and cosine. ___ ___

Content in mathematics for grade 12 should include:

1. The review and extension of concepts of sets. ___ ___

2. Permutations and combinations. ___ ___

3. Functions: definition, domain, graphical test, and methods of determining functions. ___ ___

4. Relations: definition, domain, range, and functions as a special kind of relation. ___ ___

5. Mathematical induction. ___ ___

6. Polynomial functions. ___ ___

7. Exponential functions. ___ ___

8. Logarithmic function. ___ ___

9. Circular functions. ___ ___

10. The nature of probability and statistics. ___ ___

11. The frequency of distribution. ___ ___

12. The mean and standard deviation. ___ ___

13. The binomial distribution. ___ ___

14. Sampling from a finite population. ___ ___

15. The system of rational numbers. ___ ___

16. The system of real numbers under ordinary $+$ and $=$. ___ ___

17. Axioms for ordered fields. ___ ___

18. Examples of ordered fields. ___ ___

19. Additional work on functions and relations. ___ ___

Part III

Specific Considerations

In this section, a list of some formulas and examples of content which might be taught are presented for grades 9-12. If you are in agreement that content should be taught such as is presented, please check (v) on the lines under A; if you are in disagreement check (v) on the lines under D.

Specific Content	A	D
Some of the specific examples of content and formulas that should be taught in grade 9 are:		
1. $a + b = b + a$	—	—
2. $X^2 - 6X + 8 = 0$	—	—
3. $x^2 - 16 = 0$	—	—
4. $K = \frac{mv^2}{r}$	—	—
5. $\frac{4}{12^2y^2}$	—	—
6. $2(a + 3) = 2(a) + 2(3)$	—	—
7. $6x + 15 = 33$	—	—
8. $y = kx^3$	—	—
9. $y - 4 \leq 8$	—	—
10. $2 + 3 > 4$	—	—
11. $x > 3$	—	—
12. $\{ x \mid 2 < x < 5 \}$	—	—
13. $\lvert Z - Z' \rvert - \lvert Z \rvert + \lvert Z' \rvert$	—	—
Some of the specific examples of content and formulas that should be taught in grade 10 are:		
1. $y = x^2 + 2x - 3$	—	—
2. $x^2 + y^2 = 25$	—	—

3. $P_1P_2 = \sqrt{(X_2 - X_1)^2 + (Y_2 - Y_1)}$ — —

4. $PP_1 = \sqrt{(X - 5)^2 + (Y + 4)^2}$ — —

5. $(x - h)^2 + (y - k)^2 = a^2$ — —

6. $(x - 4)^2 + (y - 3)^2 = 25$ — —

7. $\int x^2 \, dx$ — —

Some of the specific examples of content and formulas that should be taught in grade 11 are:

1. $y = mx + b$ — —

2. $2 = 1 + \frac{1}{2} + \frac{1}{4} + \ldots + \frac{1}{2^{n-1}}$ — —

3. $F = \left\{ (x, y) \middle/ y = 2x + 3 \right\}$ — —

4. $\text{Tan } e = \frac{y}{x}$ — —

5. $\text{Sin } e = \frac{1}{2}$ — —

6. Prove that the square root of 2 is not a rational number — —

7. $\frac{a}{0} = 0, \; a = 0$ — —

Some of the specific examples of content and formulas that should be taught in grade 12 are:

1. $a + b = 1\,2\,3 + 1\,3\,2 = ?$ — —

2. The graph of $R = \left\{ (x,y) \middle/ y = x^2 \right\}$ — —

3. $y = a^x$

4. $y = \log_a X$ — —

5. $Y = 6^2$ — —

6. $\frac{0}{+3}, \frac{+5}{-3}$ — —

7. $x^2 + y^2 = 13$ — —

8. $a^2 = b^2 + c^2 - 2bc \cos A$ — —